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INFLAMMATION.

Definitions.—" Inflammation is that nutritive disturbance which is characterized by active hyperæmia or congestion, and active multiplication or proliferation of the cells of a tissue or organ."—*Professor S. W. Gross.*

Inflammation is the " succession of changes which occur in a living tissue when it is injured, provided the injury is not of such a degree as at once to destroy its structure and vitality."—*Burdon-Sanderson.*

INTIMATE NATURE OF INFLAMMATION.

When studying the nature of inflammation, it is well, for its more ready comprehension, to first note the modifications that take place in the blood-vessels and their contained fluid, and then observe the changes that occur in the perivascular structures.

Active Hyperæmia.—This means an afflux or determination of blood to a tissue or organ.

The portion of the circulatory apparatus which is most directly concerned in the process of inflammatory action is the capillary system, arterioles and venules.

The capillaries are tubular masses of protoplasm, composed of flattened, nucleated endothelial cells of various forms, held together by an intercellular albuminoid substance.

The blood is a homogeneous fluid, composed of serum, together with red and white corpuscles.

The red corpuscles are circular, bi-concave disks, about $\frac{1}{3500}$ of an inch in diameter. They have no nucleus, and are chiefly concerned in carrying oxygen to the tissues; they are of greater specific gravity than the white corpuscles. They are found in the mid-current, while the white loiter along the sides of the vessels. They move with greater velocity than the white.

In the healthy state, the proportion of red corpuscles to white is as twelve hundred to one, varying, however, with different periods of the day.

The white cells are known as lymph cells, amœboid corpuscles or leucocytes. They are globular bodies of about $\frac{1}{2500}$ of an inch in diameter, and possess a nucleus.

When a part becomes inflamed, there is a slight contraction of the capillaries, with retardation of the flow of blood, dilatation of the vessels and an increased rapidity of circulation, followed by exudation of the liquor sanguinis, with migration of the white corpuscles; this is succeeded by a quiescent state of the capillaries, with complete stagnation of their contents.

It is the extravasation of the liquor sanguinis which causes the proliferation of the cells of the tissue inflamed; it is, in fact, the stimulus.

The fixed cells of the structure inflamed, and the migrated white cells absorb this liquid, increase in size, and finally proliferate in great numbers. The white cells, which are floating quietly along the sides of the vessels, in the serum of the blood, independent of the red corpuscles in the mid-stream, are now found to be greatly changed; they are seen to be packed along the sides of the vessels, the walls of which have undergone fatty infiltration or softening; they send out prolongations, and by these prolongations they attach themselves to the walls of the vessels, and, by the alternate prolongation and relaxation of their processes, they work their way through the walls into the perivascular tissue, by what is called amœboid movement, and these proliferate with the fixed cells of the tissue.

Serum of the blood, under ordinary circumstances, is largely made up of water, together with albumin, and certain saline constituents. The serum of inflammation is somewhat perverted; there is a larger proportion of albumin and of salts than in health. There is transuding through the vessels the liquor sanguinis, in which there is a larger proportion of albumin and of salts than in serous effusion, and, in addition to this, there is the presence of fibrin. It is the presence of fibrin that causes the effusion to undergo coagulation in the tissues. Such being the case, it follows that the so-called coagulable lymph is *liquor sanguinis*, with the proliferation of the white corpuscles, which have migrated through the vessels, together with the corpuscles in large numbers which have resulted from the proliferation of the fixed cells of the tissue in which the inflammation is going on; in other words, it is embryonic tissue. It will thus be seen that in inflammation the blood is changed in all its properties; vital, physical and chemical.

Changes in the Perivascular Tissues.—In addition to the vascular phenomena of inflammation, the cells of the perivascular connective tissue, be they fusiform, stellate or round, absorb the transuded *liquor sanguinis,* swell up, increase in size and multiply; the white blood corpuscles, which have migrated from the vessels, likewise proliferate, and the resulting mass of young cells absorb or eat up the fibrilla, through which the connective tissue becomes converted into a mass of small cells, held together by a semi-fluid, intercellular substance, and this small, round-cell infiltrate is called embryonic tissue; in other words, the tissues have reverted to their embryonic condition, thereby constituting the so-called inflammatory lymph. These active changes in the cells are due entirely to the stimulating influence exerted upon them by the excess of liquor sanguinis which has escaped from the vessels.

VARIETIES OF INFLAMMATION.

The *nature of the exciting causes* of inflammation are the common or ordinary causes; the specific, as those engendered by animal poison, ferments or contagious principles, such as pyæmia, septicæmia or syphilis; and the traumatic, those resulting from wounds or injuries.

The state of the patient's constitution is to be particularly studied. If he be healthy, there is a tendency to immediate repair; if unhealthy, the tendency to repair is, obviously, more remote; if he be irritable, which is characteristic of most strumous subjects, the condition of the subject will be that of nervous exaltation; finally, the patient may be in an infective state, which is one secondary to a preëxisting inflammation, and depends on putrefactive changes going on in an open surface.

The intensity of morbid action must be early taken into account. It is *latent* when it fails to reveal itself by the ordinary phenomena, as in latent pneumonia, in spinal and other abscesses, and in the ulceration of Peyer's patches accompanying typhoid fever. It is *acute* when it runs its course rapidly and the phenomena are well marked. It is *subacute* when the symptoms are not so well marked as in acute inflammation; and it is *chronic* when the disease is characterized by sluggishness.

The effusion of inflammation may be *serous*, *plastic*, *fibrinous*, or *purulent.*

TERMINATIONS OF INFLAMMATION.

The terminations of inflammation are, first, to health, by delitescence, when the disease suddenly disappears, before it has passed through its different stages; by resolution, when the disease passes regularly through all the stages of inflammation, the symptoms gradually disappearing, and the parts or organ returning to health; or, again, inflammation may terminate in death by ulceration, which is the molecular death of a part, or in mortification, which is the death of a part on a large scale, or *en masse.*

Extension of Inflammation.—Although inflammation is, primarily, a local process, it very soon shows a tendency to spread, and this may be done in various ways; by continuity of structure, as, for example, in gonorrhœa; by contiguity, as in phlegmonous erysipelas; by the lymphatics, which is, in reality, an extension by continuity; by the blood; and, finally, by nervous agency.

Etiology of Inflammation.—The causes of inflammation are divided into predisposing and exciting.

The more important *predisposing causes* are hereditary tendencies—such as gout, syphilis, scrofula; together with agents that produce debility, as shock, loss of blood, impaired nervous action, bad habits, diabetes, anæmia, plethora, age, sex, temperament, occupation, food, etc.

The exciting causes are: *thermal,* those produced by cold, or heat; *mechanical,* when caused by external injuries, as from a bullet, etc; *chemical,* when disintegration occurs from the application of corrosive substances, acids, or alkalies; and *parasitic,* the result of the ptomaïnes of microörganisms on the tissue.

THE SYMPTOMS OF INFLAMMATION

Are divided into local and constitutional. They vary with the cause, the seat of the disease, and the constitution of the patient.

Local Symptoms.—**1. Discoloration or Redness.**—This depends upon hyperæmia and determination or afflux of blood to the part; it is most marked in highly vascular tissues. It is not always a necessary accompaniment of the inflammatory process; it is not well marked in inflammation of muscular or fibrous tissues. There is no discoloration when the brain or nerves are inflamed. When there is biliary derangement, there is tendency toward a yellow color. The discoloration is most marked at the focus of the morbid action; it varies in intensity from a slight flush to a deep purple, and it may be circumscribed or diffused.

Redness is not always a sign of inflammation; to be of value in diagnosing a case, it must be permanent, not transitory, and is to be taken in connection with the other signs of inflammation.

2. **Heat,** which can be detected by the surface thermometer, is always present, no matter how deeply situated the disease may be.

It is due to an increased flow of blood, to friction against the walls of the vessels of the part and to cell proliferation.

The inflamed part is a heat-producing area, thus causing fever by overheating the blood.

The two symptoms always present in inflammation are heat and disordered function.

3. **Tumefaction or Swelling.**—This is due to capillary engorgement, effusion of *liquor sanguinis* into the perivascular structure, and tissue metamorphosis, or cell proliferation. The amount of swelling varies with the nature of the tissue inflamed; in dense tissue, such as bone and cartilage, there is very little swelling; it is most conspicuous in parts where there is an abundance of lax connective tissue.

When a serous or synovial membrane is inflamed, the effusions are poured into the cavities which they form.

It may be soft, and pit on pressure, resulting from inflammatory œdema, or it may be hard, when it is due to fibrinous exudation.

This condition may prove beneficial by unloading the blood-vessels, or it may do harm by cutting off the blood supply, or by causing an obstruction, as in œdema of the glottis and stricture of the urethra.

4. **Pain** is usually felt at the seat of the morbid action, but in exceptional cases it is experienced in parts remote from the disease; hence, it does not always *point out* the situation of the inflammation, as, for example, in psoas abscess, latent pneumonia, coxalgia, and vesical calculus.

Pain sometimes suddenly leaves a part, which is a sign of commencing mortification, unless this condition be due to the influence of opiates previously administered.

Pain is more violent when the covering of an organ is affected than when an organ itself is inflamed, as, for example, in pleuritis and peritonitis.

The *causes* of pain are, compression, stretching, irritation, and disorganization of nerves; it is variable in degree. Its character varies: it may be sharp and lancinating, as in inflammation of serous membranes; acute and throbbing, as in formation of pus; dull and heavy, as in periostitis; annoying, as in toothache; sickening, as in inflammation of the testes; itching, as in affections of the skin; or burning and scalding, as in gonorrhœa.

Pain in inflammation comes on gradually, is persistent, aggravated by pressure and muscular contraction, and is fixed; there is febrile disturbance, accompanied by redness heat, and swelling. The pain of spasm comes on suddenly, is intermittent, relieved by pressure; is not fixed, there is no fever, and it is not accompanied by redness, heat, or swelling. The pain of neuralgia is paroxysmal and intermittent, is aggravated by pressure, and, like that of spasm, is not fixed, and is unaccompanied by fever, redness, heat, or swelling.

In very dense tissue the pain is throbbing, which, in a great majority of cases, denotes the formation of pus. Pain is aggravated by the dependent posture of the part.

5. **Functional Disorder.**—In inflammation there is increased sensibility, as, for example, in carbuncle, boil, whitlow, etc.; impairment of special function, as when the eyes, nose, and larynx are affected; increased irritability due to reflex muscular phenomena, as in cystitis, gastritis, dysentery, etc.; and derangement of the secretions, as when the skin, liver, kidneys, etc., are attacked.

Constitutional Symptoms.—In mild cases there is no general constitutional disturbance; but if the inflammation be at all severe, the condition known as fever will ensue. The one sign characteristic of fever is elevation of temperature, and it is an index to the morbid action.

Fever generally manifests itself about twenty-four hours after the local inflammation is established; it is generally ushered in with a chill or what is termed a *rigor*. Although the patient feels cold, if his temperature be taken, it will be found to be above normal. A succession of chills denotes sudden increase of temperature. It continues to rise, and, after a varying interval, the patient feels excessively hot, then a profuse perspiration may break out, the temperature fall more or less, and the rigor is over.

As a rule, the temperature of the rectum and of the vagina is one degree higher than in the axilla. The temperature in the morning should be taken between the hours of 7 and 9 o'clock, and that of the evening between 5 and 7 o'clock.

Another set of symptoms depends on the scantiness of the secretions of the body. The tongue becomes furred and unclean, there is a great thirst, want of appetite, the bowels are constipated, the urine is smaller in quantity and high colored, the skin is hot and dry, the respiration and heart's action are increased.

Nervous complications arise; the patient is languid, and complains of severe headache, which may be followed by a confusion of ideas, going on to delirium.

TRAUMATIC FEVERS.

Traumatic, or Surgical Fever, is divided into two varieties:—Primary Wound Fever and Secondary Wound Fever.

Causes of Traumatic Fever.—The general symptoms of traumatic fever appear mainly to depend upon materials absorbed from the wound; for whatever prevents the free escape of the discharge causes an accession of fever, and this is done: by small particles of heated blood coming from the inflamed area, and being continually added to the circulating mass; by the addition to the system of pyrogenous or fever-producing material propagated at the site of the inflammation; these are lymph, fibrin, and fibrin ferment; and, when present, the ptomaïnes of the microörganisms. These agents are carried by the blood to all parts of the body, and start an active oxidation or combustion; the result is heat; they likewise act on the heat centres.

Again, the temperature falls on establishing sufficient drainage, and the measures taken for keeping a wound aseptic minimize the fever.

The latter fact seems to prove that traumatic fever is, to a great extent, a state of septic intoxication, though the chemical products of inflammation are themselves pyrogenous. In all wounds the injury destroys the vitality of a certain amount of tissue, and the necrosed structures are resolved into simpler compounds.

In open and exposed wounds these compounds further decompose and furnish secondary products, which, on being absorbed, induce fever.

Allowance must be made for the check on the cutaneous perspiration and the general effect of nerve irritation.

PRIMARY WOUND FEVER.

The *aseptic-traumatic* or Primary Wound Fever is due to the absorption of the wound exudate, which contains pyrogenous material, and produces fever. Illustrations of this form are the rise of temperature following a simple fracture; or those which follow large aseptic wounds healing by first intention; wounds healing without drainage.

The fever is of short duration, lasting usually from two to three days. The temperature rarely rises above 101° F., though it may reach 102° F. The patient is conscious of being unwell, but suffers little inconvenience. It is the form of fever known as "the post-operation rise."

Attention to the bowels, easily digested food in small quantities and frequently repeated, is the recognized treatment. Should the temperature show a tendency to rise above 102° F. the wound should be freely drained.

SECONDARY WOUND FEVER.

There are two varieties of this form of fever: Traumatic or Surgical Fever, and Septic Traumatic Fever.

TRAUMATIC OR SURGICAL FEVER.

Traumatic or Surgical Fever occurs in those cases where an operation has not been performed antiseptically and before they have come under the care of the surgeon. The direct cause is probably the action of bacteria on the secretions of the wound, which give rise to a process of fermentation during which ptomaïnes are developed, which being introduced in the circulation, engenders this form of fever. As soon as suppuration is freely established and the granulation process begins, the chemical poison which caused the fever is no longer absorbed and the temperature falls.

Symptoms.—This fever is characterized by great force; the temperature is from 100° F. to 103½° F. There is an increased intravascular pressure, as manifested by the pulse, which is frequent (from 85 to 120), hard, strong, full, and incompressible. There are, however, exceptions to this rule, as in peritonitis, where the pulse is hard, small, frequent, and wiry. The face is suffused, the eye watery, and the skin is hot, dry, and harsh; the respiration is frequent and labored; the tongue is coated with a whitish, brownish, or yellowish fur; the mouth is parched and dry; the taste vitiated. The patient may suffer from anorexia, nausea, and sometimes bilious vomiting. As a rule, the bowels are constipated and the discharges offensive.

Fig. 1.

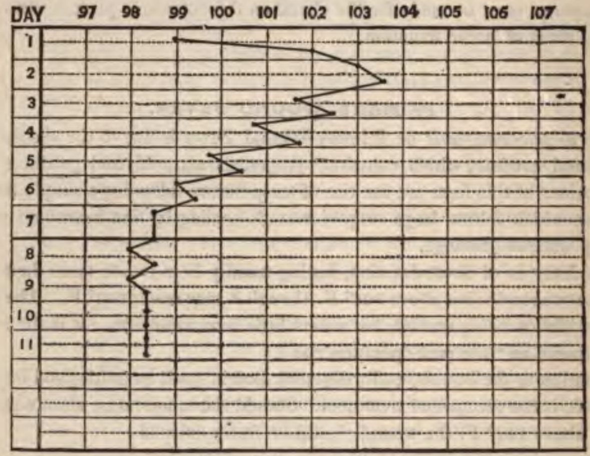


Chart of Traumatic Fever.

The urine is scanty and diminished one-quarter to one-half in quantity from the natural condition; it is high-colored, of a reddish tint, and deposits lithates or urates while cooling; it sometimes contains albumin and tube casts; it is more or less offensive.

There is a peevish and fretful condition of the mind, frontal headache, loss of sleep, and when asleep the patient is disturbed by dreams. There may be delirium and perversion of the organs of special sense.

There are generally severe pains in the back and loins; nutrition is greatly perverted; assimilation is held in abeyance; the patient does not wish to partake of food; the tissues begin to waste, the fat disappears, and emaciation follows rapidly, more so than when caused by inanition.

It reaches its climax in from two to four days, and then gradually disappears. In ordinary uncomplicated cases all signs of inflammatory fever disappear by the end of the first week.

Treatment.—The wound should be treated antiseptically, freely drained, and all infected stitches removed; internally, all that is indicated is a tonic treatment, such as quinine and iron; opiates to be given if necessary; great attention should be paid to the diet and to the state of the bowels.

FIG. 2.

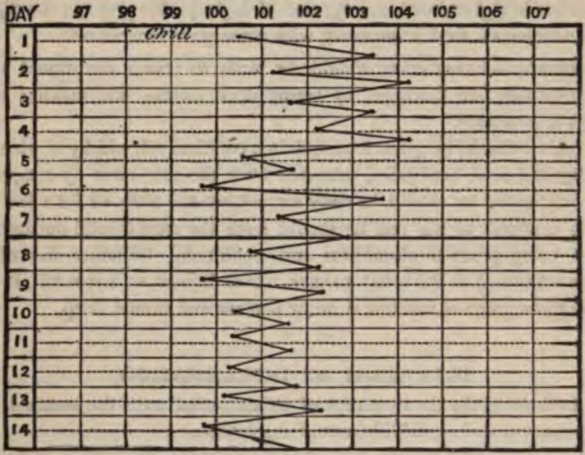


Chart of Septic Traumatic Fever.

SEPTIC TRAUMATIC FEVER.

Septic Traumatic Fever is called *Hectic Fever* when it occurs as a complication in tuberculous cases. It is due to the retention of pus in wounds after suppuration is established, and is also due to absorption of a chemical poison produced by pyogenic cocci.

The temperature varies from 100° F. to 106° F., and is liable to oscillations, reaching its highest point in the evening and falling two or three degrees by morning.

It is generally ushered in with a chill, or there may be successions of chills, which may recur every other day or every third day, and which will be followed by increased fever and profuse perspiration.

The pulse is weak, tremulous, soft, compressible, and frequent, varying anywhere between 100–160 per minute. The respiration is oscillating; in very severe cases it may reach from 20 to 25 per minute.

The countenance is pallid; the features are pinched, and the individual has a listless look, presenting what is known as the Hippocratic countenance; the skin is cold and clammy; the tongue is dry, hard, and covered with a brownish or blackish fur; there are sordes on the gums and teeth; the stools are offensive and tarry; or there may be fetid diarrhœa. There are spasmodic twitchings, with hiccough and subsultus tendinum. The senses are obtunded, the mind is obtuse, and there is low, muttering delirium, with picking of the bedclothes, etc.

The urine is high-colored, scanty, and of high specific gravity; the digestion and assimilation of food is impaired, with consequent emaciation.

Treatment.—Every effort should be made to render the wound aseptic, and to establish free drainage, by laying open sinuses and making counter openings if necessary.

The patient should be given iron, quinine, cod-liver oil, whisky or wine, light, easily digested food, beef juice, extracted from the raw meat by compression. When practicable he should be daily carried into the fresh air for a few hours. If he is confined to his bed he should have the most careful nursing, every attention being given to cleanliness and ventilation. Diarrhœa and sweating are to be controlled in the usual manner. Malt liquors, or hypnotics, if necessary, are to be given at bedtime if he be restless and cannot sleep.

TREATMENT OF INFLAMMATION.

The indications for the treatment of inflammation are: the removal of the exciting cause and the establishment of resolution.

As long as the exciting cause remains, the inflammation will continue; after its removal, the disease generally terminates spontaneously.

To establish resolution the treatment is divided into general, local, and constitutional.

The General Treatment, which is adapted to all stages of inflammation, is rest, elevation, and relaxation of the affected part. Local rest may be procured by bandages, splints, or weights; the efforts of the patient to avoid the pain of motion will act as a splint. Elevation of the affected part acts as a restorative to the equilibrium of the circulation by retarding the ingress of arterial blood in undue quantity and expediting the return of venous blood.

To obtain relaxation, the affected part must be placed in such a position as to relax all the tissues in the immediate neighborhood.

Local Treatment.—The first stage is that of engorgement or of increased intravascular pressure, with commencing effusion; to lessen stasis, restore the tonicity of vessels, and relieve the perivascular tissue of effused material, local bleeding is resorted to. By this means the flow of blood through the inflamed part is accelerated, thus washing out, so to speak, the adherent white corpuscles and breaking up the rouleaux of red corpuscles, as well as relieving in part the surrounding tissues of the excess of liquor sanguinis and white cells, due to inflammatory extravasation, by the operation of the well-known law of capillary attraction. The materials that caused the engorgement having disappeared, the capillaries again resume their normal condition.

Local depletion may be effected by Punctures, Scarification, Leeching, or Cupping.

Puncturation may be employed when there is great tension, as in tonsillitis, hemorrhoids, etc.

Scarifications; incisions varying in length, are resorted to in inflammation produced by infiltration of urine, chemosis, etc.

Leeches are usefully applied to the neighborhood of inflamed parts, but should not be put on the inflamed surface itself. They should be placed between the inflamed part and the heart. If it is desired to remove a leech after a certain time, this may be accomplished by sprinkling salt upon it. The bleeding may be stopped by applying to the part nitrate of silver, muriated tincture of iron, spider's web, the actual cautery, or styptic cotton. The flow of blood from a leech-bite may be continued by the application of warm water.

Cupping is more painful than scarifications or leeching. Cups should not be applied for inflammation below the diaphragm.

The supply of blood to an affected part may be cut off by ligation of the artery leading to the seat of disease; by compression, either by tourniquet or with the fingers; or by flexion, as by flexing the forearm on the arm.

The application of *cold* is frequently of service; either spring water or ice water may be used. A cooling lotion, consisting of alcohol one part and water one part, or saltpetre (nitrate of potassium) five parts, chloride of ammonium five parts, and water sixteen parts, is recommended, care being taken that the temperature is not kept below 45° F. The cold lotions may be contained in ice bags.

The effect of cold applications is very powerful in the treatment of inflammation; it restores the tonicity of the capillaries by contracting their calibre, thus retarding effusion into the surrounding structures; it reduces the temperature; it arrests tissue metamorphosis and promotes diffusion of the effused materials into the vessels; it relieves tension and pain by restoring the equilibrium of the vessels.

The application of cold is contraindicated in asthenic types of fever, in old persons, and in young children.

When the second stage or that of plastic effusion is fully established, compression should be employed by means of a muslin or elastic roller bandage, adhesive strips, compressed sponge, or bags of shot. These act by giving support to the blood-vessels, restoring their tonicity, and facilitating the absorption of effused material.

Acetate of lead is applicable to all cases of external inflammation; it acts as an astringent, sedative, and sorbefacient; it is usually employed in the strength of eight grains of the salt to one ounce of water.

Chloride of ammonium is used in the same strength as the acetate of lead. Tincture of iodine is employed in the same manner as the salt of lead; it is especially beneficial in œdematous inflammation. It should be applied directly over the seat of morbid action; it is usually diluted about one-half with alcohol.

Nitrate of silver, varying in strength from two grains in an ounce of water to the application of the solid stick, depending upon the purpose for which it is employed, is a remedy frequently resorted to.

The cold or hot douche is beneficial in stimulating the absorbents; it is especially applicable in sprained ankle.

Massage is efficacious in getting rid of extra-articular adhesions.

The stage of threatening or fully-established suppuration may be called the third stage; the indication is to favor the formation of pus.

The symptoms of the advent of the third stage are augmented tension of the part, with throbbing pain and an increased swelling, and this condition is to be met by the application of heat and moisture, by means of fomentations, stupes, continuous warm baths, and poultices.

Counter-irritants are particularly applicable in cases of subacute and chronic inflammations; they act by causing an afflux of blood to points of application, thereby producing anæmia to the inflamed part beneath.

There are three classes of counter-irritants, viz.: rubefacients, vesicants, and suppurants.

The *rubefacients* are: mustard plasters, turpentine stupes, tincture of iodine, ammonia liniment, capsicum.

The *vesicants* are employed to produce superficial inflammation and vesication. They are cantharides, collodium cum cantharide; equal parts of powdered carbonate of ammonia and lard; lint saturated with chloroform applied to the part and covered with oiled silk.

Suppurants are agents used to produce suppuration; they are croton oil, issues, setons, tartar emetic ointment, actual cautery.

Constitutional Treatment.—General bloodletting is to be used when the inflammation is characterized by high vascular pressure, in strong, robust individuals. Bloodletting is likewise indicated in inflammation of any of the great viscera or their coverings; especially is this the case in acute cerebral congestion. To be of use it must be resorted to in the first stage of inflammation.

Bloodletting is contraindicated during epidemics, in typhoid conditions, gangrenous, ulcerative, or suppurative processes, erysipelas, in corpulent persons, in extremes of age, in drunkards, and in nervous individuals.

The effects of general bloodletting are to relieve arterial tension, diminish the volume, accelerate the current of the blood, relieve the tissues of effused material, and reduce the temperature by withdrawing a large amount of pyrogenous or fever-producing material from the general circulation. It likewise promotes the action of other remedies.

When these desirable effects are produced, the condition may be maintained by the use of arterial sedatives, such as tincture of veratrum viride, aconite root, gelsemium, tartar emetic.

The *diaphoretics* in general use are acetate of ammonium, citrate of potassium, Dover's powder, fluid extract of jaborandi, muriate of pilocarpine, lemon juice, with bicarbonate of potassium.

The *diuretics* in use are infusion of digitalis, salts of potassium, citrate of caffein, colchicum, cocaine, coffee, etc.

Cathartics are used to evacuate the bowels, deplete the mucous membrane, excite the action of the liver, salivary glands, and mucous follicles, and to stimulate the absorbents, thereby inducing them to remove inflammatory deposits.

Enemata of warm water, or soap and water, to which turpentine or vinegar may be added, are frequently employed. Glycerine suppositories may be used to unload the bowels; to take the place of cathartics.

Emetics are indicated when the skin is hot and dry, the tongue heavily coated, and when there exists a sense of great weight at the epigastrium. All emetics should be followed by copious draughts of warm water. The emetics generally used are alum in doses of a drachm, sulphate of zinc in scruple doses, sulphate of copper in like quantity, mustard and salt, ipecacuanha in scruple doses, tartar emetic in two-grain doses. Emetics should not be prescribed in inflammation of the brain, eye, or of the viscera below the diaphragm.

Mercury is indicated when the pulse is soft, skin relaxed and moist, and when there is a general tendency to restoration of the secretions, and not before. It reduces the plasticity of the blood and causes absorption of the embryonic tissue. It is of great benefit in membranous croup, hepatization of the lungs, iritis, syphilitic inflammation, and such like diseases. It is usual to combine with the mercury a small quantity of opium, to prevent its being carried off by the bowels.

It is contraindicated in persons of strumous habit; the old, ill-fed, badly nourished, and the anæmic.

Mercurialism is indicated by a peculiar fetor of the breath, red and tumid gums, metallic taste in the mouth, an increased flow of saliva, ulceration of the buccal mucous membrane, and diarrhœa. *The treatment* for this is astringent gargles; Goulard's extract, one ounce to water eight ounces, used every hour or two; alum, tannic acid, copper, zinc, atropia by hypodermic injection, chlorate of potassium in doses of 20 to 30 grains three times daily, morphia, p. r. n.

Anodynes.—Opium is applicable to the treatment of inflammation in all stages of the disease.

The exhibition of opiates should be preceded by bloodletting when admissible; in other cases by a cathartic. The remedy should be administered in full doses, as small doses act as stimulants, while larger doses act as sedatives.

Hypnotics.—When the patient is restless but not suffering acute pain, hypnotics are indicated, such as phenacetin, gr. v, antikamnia, gr. v, sulphonal, gr. xv, bromide of potassium, gr. xxx, chloral, gr. x, taken at bedtime, paraldehyde in doses of one drachm freely diluted, or hydrobromate of hyoscine in doses of $\frac{1}{120}$ of a grain, may be used; if the patient suffers great pain, one-sixth of a grain of any of the salts of morphia may be added. Sometimes a glass of milk punch, ale, or whisky will answer.

Tonics.—The principal are quinine, iron, and nux vomica, or its equivalent, strychnia.

Antipyretics.—These are principally quinine, given in twenty-grain doses, administered about an hour before the evening exacerbation; salicin in doses of about fifteen grains during the intervals, antifebrin or antipyrin administered by the stomach or hypodermatically.

Antiphlogistic Regimen.—In the early stages of inflammation, the patient has no desire for food, nor should he be induced to eat, as it may produce a feeling of great distress, as well as nausea. At this period iced lemonade is very grateful. After the administration of a cathartic, a fluid diet may be resorted to. Suitable articles are beef tea, milk, soups with the fat skimmed off, Valentine's meat, Johnson's fluid beef, koumiss, raw oysters, sweetbreads, soft-boiled eggs, eggnog, etc. A patient on a liquid diet should have at least two pints of milk with one pint of beef tea during twenty-four hours. Stimulation by brandy, whisky, sherry, Madeira wine, etc., must be resorted to when necessary.

Nutritive Enemata.—When the patient is unable to bear diet by the stomach, then rectal injections of nutritious substances must be resorted to. A dietary enema should not exceed three ounces. The following articles may be used: Johnson's fluid beef, milk, eggs, or milk and eggs combined, and beef tea. An injection should be repeated about every three hours. To each injection should be added five grains of pepsin and five grains of pancreatin, together with ten drops of dilute hydrochloric acid and one drop of carbolic acid. When milk is used, the hydrochloric acid should be omitted.

Good ventilation is absolutely necessary. The temperature of the sick apartment should range from 68° F. to 70° F.

Cleanliness and *Quietude* should be strictly enforced.

PATHOLOGICAL TERMINATIONS OF INFLAMMATION.

Pathologically inflammation terminates in one of three ways: By the effusion of serum, by the effusion of lymph, and by the effusion of pus. They are all results of inflammation and perform an active part in the inflammatory process. Serum is simply the liquor sanguinis of the blood, the pabulum upon which the proliferous cells subsist. Lymph is the embryonic tissue of the inflamed part.

Effusion of serum denotes a mild type of inflammation. It is not serum but the liquor sanguinis of the blood altered in its composition; the structures in which it is most generally present are loose connective tissues and serous cavities; large quantities are sometimes poured out by the mucous membranes of the alimentary canal, as in diarrhœa and cholera.

When the effusion accumulates in parts endowed with abundant connective tissue, there will be œdema. If the effusion is into a joint or serous cavity there will be dropsy, or general œdema.

In œdema the parts present a soft, glazed, inelastic swelling which pits on pressure. Dropsy in cavities is detected by palpation and percussion.

Treatment of the Terminations of Inflammation.—*Local.*—By tapping when in a cavity; by punctures when in connective tissue; by incisions when gangrene is threatened; by compression to promote absorption; by sorbefacients, the principal of which are iodine, acetate of lead, chloride of ammonium, nitrate of silver, hot and cold douche, and massage. The *constitutional treatment* is by hydragogue cathartics, diuretics, and mercurials.

Deposit of Lymph denotes a higher grade of inflammation than effusion of serum. There are two varieties, plastic and aplastic. The plastic lymph is the formative variety, and is capable of being organized; on the contrary, aplastic lymph cannot be organized and is non-formative. This variety of lymph forms the linings of sinuses and fistulas, and prevents their healing.

A deposit of lymph disappears by absorption, atrophy, pus formation, fatty degeneration, and calcification. Should it remain, it will be as a permanent thickening; or it may be employed to repair the structures damaged by inflammation.

The local treatment is the same as that for effusion of serum; the constitutional treatment will require the exhibition of alteratives and tonics, such as iodide of potassium, bichloride of mercury, iodide of iron, etc.

SUPPURATION.

Suppuration is the formation of pus in a part. It is most commonly found in the connective tissue, serous and mucous membranes, and in the lungs.

Pus is a fluid, new formation, made up of serum, albumin, salts, pyine, fatty matter, and certain salts; its solid constituents are corpuscles, shreds of connective tissue, and granules of fatty matter. The microscope reveals the presence of micrococci, upon which suppuration depends. Fibrin is never found in pus because the micrococci of suppuration feed upon the fibrinogen and prevent the formation of fibrin; hence pus does not coagulate.

Pus effects a good purpose in facilitating, loosening, and extruding foreign substances and in assisting granulation; the good effects, however, are more than counterbalanced by the bad, which are destruction of tissue and exhaustion of the patient.

The varieties of pus are: 1. Healthy or laudable pus, which is an "opaque, homogeneous, yellowish fluid, of an alkaline reaction, mawkish odor, sweetish taste, and of a specific gravity of about 1021 to 1040." 2. Sanious, or ichorous pus, which is a product of unhealthy inflammation; it is thin, highly acrid, and of a reddish color. 3. Fibrinous pus is semi-fluid, of a whitish or ash color, with flakes of fibrin; it is found in inflammation of the joints. 4. Gummy pus; highly gelatinous, met with in tertiary syphilis. 5. Muco-pus, *i. e.*, pus mixed with mucus. 6. Contagious pus; the variety met with in smallpox, gonorrhœa, and in venereal ulcers.

Pus is usually formed in from twenty-four to seventy-two hours, but the time will vary much with the constitution of the patient and the structure of the part in which the inflammation is seated. It always works its way to the point of least resistance.

When pus is formed under fascia, or deep in the mamma or pelvis, and cannot make its way to the surface, the constitutional symptoms are much more severe.

Symptoms.—The formation of pus is often attended with severe constitutional irritation; there are rigors succeeded by heat, and if the inflammation be extensive or seated in any vital organ, the constitutional disturbance will be very severe, and the shivering, which indicates the formation, will also be severe, and followed by powerful reaction. When the pus is easily produced, there may be little or no rigor; as upon a mucous membrane.

ABSCESS.

An abscess is a circumscribed cavity of new formation containing pus.

Abscesses are known as superficial, deep-seated, acute, or phlegmonous, chronic, common, specific, and residual.

An acute abscess is one that runs its course rapidly, and is always accompanied by well-marked inflammatory symptoms. It is, from its great frequency, one of the most important of surgical diseases. When an inflamed part becomes more heated and more swollen; when the skin assumes a dusky hue, and becomes glossy and shiny; when the pain, which has been of a dull, heavy nature, becomes persistent, steady, and throbbing, and when the skin over the swelling is œdematous, then there can be no doubt that an abscess is formed.

Pathology.—In the formation of an abscess the first phenomena are those of inflammation, which have been already described; when the production of embryonic tissue has been reached, if it stops at that point resolution is established and recovery ensues; but should the new "cellular infiltrate" be invaded by the microörganism of suppuration, and a suitable soil for its nidus and growth be found, they will be nourished by the albumin in the tissues; and it is their excreta, known as ptomaïnes, which peptonize the fibrin and change the embryonic tissue to a liquid, which is pus.

The changes here described begin in the lymph spaces, so that an abscess never has its commencement at a single focus; the accumulation of liquid and cells causes the lymph spaces to be greatly distended; the fibrous tissues separating these spaces are widely pressed asunder, causing their supply of blood to be cut off, sloughing being the result; moreover, the living pus cells find in these fibres a source of nourishment, and they are thus destroyed; hence the lymph spaces become converted into a single cavity, and an abscess is formed.

From the periphery to the centre of an abscess all stages of inflammation are presented, from the first, which is the stage of congestion, to the last, which is the period of the formation of pus.

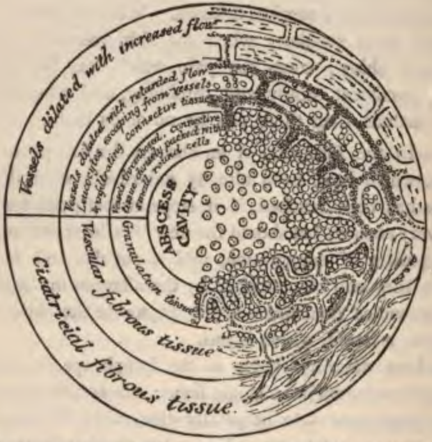
Between these two conditions, there is a middle point where the inflammatory process has reached only the formation of embryonic tissue, and hence it is that the cavity of an abscess is always circumscribed by a tissue of new formation.

Not only does an abscess extend in various directions, but all abscesses tend to empty themselves at the point of least resistance; they approach the surface, where they spontaneously evacuate themselves, their tendency being toward the skin. The abscess discharges itself by a small opening, which is due to the death of a limited portion of the skin.

The contents of an acute or phlegmonous abscess are laudable pus, micrococci, and some little shreds of dead tissue. In some cases the abscesses contain air, when the contents are extremely fetid.

A phlegmonous abscess occurs in all periods of life, in all classes of persons; it varies in size; is most frequently met with in subcutaneous connective tissue, in the muscular tissue, around the lymphatic glands, and around the bones. Its most common sites in the viscera are the liver and brain.

FIG. 3.


Vessels dilated with increased flow
Vessels dilated with retarded flow
Leucocytes escaping from vessels
& infiltrating connective tissue
Vessels thrombosed, connective tissue densely packed with small round cells
ABSCESS CAVITY
Granulation tissue
Vascular fibrous tissue
Cicatricial fibrous tissue.

Diagrammatic Representation of the Minute Changes in the Formation and Healing of an Abscess. The upper half shows abscess enlarging; the lower half abscess healing. (*Walsham.*)

Tuberculous Abscess.—*Cold Abscess*, *Strumous Abscess*, or *Chronic Abscess.*

The effect of the bacillus of tuberculosis on tissue is to produce a chronic inflammation which results in the production of granulation tissue; this is the so-called pyogenic membrane of old authors, and acts as a protective wall to the surrounding tissue.

The degenerative changes that take place are caused by local anæmia and by the chemical action of the ptomaïnes of the tubercle bacilli; they consist of a caseation and liquefaction of the cheesy material. This puruloid material has hitherto been looked upon as pus; it is now known to be tissue which has undergone metamorphosis. Pus is never present in a tubercular process, unless the microörganism of suppuration be present, when there will be a mixed or double infection.

If the bacillus meet with sufficient resistance by the surrounding tissue, it exhausts the nutritive material in the granulations and dies; or it remains in a latent condition; the granulation is converted into a cicatricial tissue, and the local lesion is cured. This is designated spontaneous cure. The liquid may also be absorbed when a similar favorable termination is possible. If the cavity is opened under antiseptic precautions, cure is accelerated; if, however, secondary infection with pus microbes takes place, the patient is in danger of septic infection, as well as local and general dissemination of the tubercular process. See *Psoas and Lumbar Abscess*, p. 195.

Treatment of Suppuration.—Remove, if possible, the morbid condition of the constitution on which the disease depends; gentle purgatives may be useful, and exciting causes, such as thorns, splinters, etc., should be removed.

Poultices are highly beneficial; they relax the skin, soothe the pain, and encourage the formation of pus.

Good substitutes for poultices are warm water dressings and the *spongiopiline.*

The treatment of an acute abscess consists in the early evacuation of the pus. The incision must be made before the pus has an opportunity to open into parts which should be spared, and it must be made at the point from which the best drainage can be procured.

All abscesses must be treated with antiseptic precautions, because microorganisms are in the tissues circumscribing the abscess; following the directions given in the article under the head of Antiseptic Surgery, page 52.

The *tubercular abscess* must not be allowed to open itself spontaneously. This precaution is to be particularly borne in mind when the glands of the neck are affected.

Open the abscess in the most dependent portions, using a straight, sharp bistoury for the purpose; press out the accumulated material; scrape out the abscess thoroughly; wash it with an antiseptic solution of bichloride of mercury, then bring the opening together by means of a suture; insert a drainage tube, and place upon the outside iodoform gauze.

Before opening an abscess of large size, and after ether has been administered, give one-sixth of a grain of morphia hypodermatically, and also administer one grain of opium every eight hours. The effect of opium is to prevent capillary hemorrhage after the removal of pressure.

Constitutional Treatment.—Where the suppuration is profuse, tonics, such as iron, quinine, strychnia, together with good, nutritious diet, milk punch, etc., with change of air, must be insisted upon.

ULCERS.

An Ulcer is a solution of continuity in any of the soft parts of the body, attended with inflammation and a discharge of pus, ichor, or sanies.

Ulcers are divided into *acute* and *chronic*, according to the intensity and rapidity of the morbid action.

The ordinary ulcer may have begun as a wound or bruise, abscess, or other disease or injury; the granulations are small, numerous, florid and pointed, and yield a moderate secretion of healthy pus.

Cicatrization begins with an absorption of swelling around the wound and a contraction of its margin; its edge begins to look smooth and bluish, and a thin pellicle of new cuticle gradually spreads from the edge, in a converging circle, till the wound is closed.

An acute ulcer is distinguished by the rapidity of its progress and the severity of its symptoms.

The pain is often a prominent symptom; it varies in character, being sometimes throbbing and again sharp and pricking, dull, heavy, and gnawing.

When the ulcerative action is rapid and extensive, there is more or less fever, with thirst, restlessness, loss of sleep, and excitement of the pulse.

The tissues most disposed to ulceration are the skin and mucous membranes; the areolar tissue ulcerates very easily; muscles, blood-vessels, and nerves very slowly; tendons and ligaments are very slow to ulcerate; but cartilage, bone, and the cornea are sometimes extremely liable to it.

Weak and cachectic constitutions are most liable to ulceration. The parts usually affected are those where the circulation is most weak and languid; such as the legs, especially if the veins be varicose.

Treatment.—In *acute ulcers* the patient should be kept in bed, with the limb raised on a pillow; saline purgatives must be administered. Calomel and blue mass should be combined with a saline cathartic. Pain must be relieved by opiates. Soothing applications, such as poppy lotion, or acetate of lead and opium, should be resorted to; cold or warm lotions, as are most agreeable, should be applied.

In many cases a tonic and stimulating treatment will be better suited to the patient; when used, quinine and iron are the remedies most in vogue, and a diet nutritious and generous must be added.

If the inflammation runs high, it is well to draw blood by scarification. From six to a dozen vertical incisions, not quite skin deep, are made over the inflamed surface around the sore, and the blood is permitted to flow until the patient shows signs of approaching syncope, if he be at all plethoric, or, at all events, until the engorged vessels have been thoroughly unloaded, which will be denoted by the comparative pallor of the part.

If scarification is not resorted to, the plan to be pursued is to paint the parts surrounding the ulcer with a solution composed of equal proportions of alcohol and tincture of iodine; then envelop the whole with a hot solution of acetate of lead.

Under the influence of rest, elevation, and the remedies here prescribed, the inflammation will disappear and granulations will begin to make their appearance. If the bottom of the sore is foul, before applying the iodine or acetate of lead, sprinkle it with iodoform.

In the early stages of the disease water dressing medicated with bichloride of mercury (1–1000) lotion should be used; when the discharge becomes healthy, pieces of lint saturated with the lotion should be laid on the sore; then strips of adhesive plaster should be applied *two-thirds around the limb*, from an inch below the ulcer to an inch above it; the plaster should be so applied that the edges of the sore may be drawn together with a moderate degree of force; then a compress of soft linen should be placed over the plaster, and finally the limb should be bandaged from the toes to the knee. The parts should be kept clean and washed every day with soap and water.

Phagedenic Form of Acute Ulcer.—This variety of ulcer spreads with great rapidity, destroying everything within its reach. It is frequently met with in persons broken down with disease or who are much debilitated. The bottom of a phagedenic ulcer is liable to be covered with a slough which is of grayish color. The discharge is serous, profuse, and highly offensive.

Treatment of Phagedenic Ulcer.—Cleanse the part by soaking up with absorbent cotton all the discharges from the ulcer that may be present; then destroy the edges of the ulcer with some one of the acids. When this has been done, touch the edges of the sore with absorbent cotton saturated with nitrate of mercury one part, water eight parts, and insert the cotton under the undermined edges of the sore. Having done this, sprinkle the edges with iodoform. Surrounding the slough is an acutely inflamed surface; paint this with the tincture of iodine and dress the limb with a hot solution of acetate of lead and laudanum, keeping the parts in an elevated and relaxed position. Give the patient nourishing diet, quinine and iron, with stimulants if necessary. If the pain is severe, administer one grain of opium every eight hours.

In the irritable form of acute ulcer, when, in addition to the surrounding inflammation, the ulcer itself is not only the seat of intense pain, but is extremely sensitive to the touch, the best mode of treating the irritated points is to insert a bistoury underneath them, make a small incision, and divide the nerve; then paint the surface with a solution of nitrate of silver, gr. x to water ℥j; dress with solution of chloral hydrate of like strength, as recommended by Professor Keen.

A Chronic Ulcer may be the sequel of an acute ulcer, or it may be chronic from the beginning. It is characterized by slowness of progress, and the comparative absence of constitutional symptoms; it has its surface smooth and glassy, more or less irregular, and is of a pale ashy color; sometimes it displays a crop of weak granulations; the edges are raised, thick, white, hard, or callous and insensible; in some cases they are thin, ragged, and serrated, the discharge being scanty and thin.

Ulcers are frequently stationary for a great length of time, and from slight causes may enlarge rapidly, by ulceration or sloughing; and even when they have made considerable progress in healing, they may without any manifest reason quickly retrograde.

A fistula or sinus is a narrow channel, lined by a pseudo-mucous membrane, which may or may not lead to a suppurating cavity.

A varicose ulcer is one that is seated on a leg the veins of which are varicose.

For the treatment of chronic ulcers all the mineral and vegetable astringents may be tried in turn: mercury, tannin, catechu, zinc, iron, copper, alum, silver; for general use, sulphocarbolate of zinc is one of the best; it contains the astringency of the zinc, with the antiseptic virtues of the carbolic acid. For reducing thick, callous edges, the ointment of nitrate of mercury is greatly praised. Acid nitrate of mercury, diluted with eight or ten parts of water, is highly recommended. Fetor is allayed with the chlorides.

The treatment of varicose ulcers and of chronic ulcers generally by the use of Baynton's plan of inclosing the limb in strips of adhesive plaster, regularly applied from the foot upward, has long been in use. Preference is given to the elastic bandage recommended by Dr. Henry A. Martin, of Boston.

In varicose ulcers the destruction of the affected vessels by Vienna paste or by ligation may be necessary.

If the ulcer depends upon necrosed bone, it must be extracted, and any carious bone should be scraped away, or removed with the chisel, gouge, or scalpel.

Sinuses are to be laid open with the bistoury, guided by the director.

GRANULATIONS

are small vascular prominences consisting of embryonic tissue growing on the surface of wounds or ulcers, by which the healing process is carried on.

If the surface of an exposed wound be examimed, it will be found that within a few hours of its exposure it is covered with a film of peculiar, gelatinous, grayish-white appearance.

After an interval of some hours, the parts covered with this gelatinous film become more vascular, as indicated by redness, and the surface becomes more even. After the lapse of twenty-four hours or longer, the surface is covered with a number of elevations, known as *granulations*, varying in size from a millet seed to a hemp seed, the smaller being highly vascular and red, and the larger paler and more bloodless. The wound is granulating; the secretion from these granulations is of a creamy-yellow character, and is called *pus*. If the surface is kept in an aseptic condition, there will be no pus. Each granulation contains a vessel, the walls of which consist of a thin membrane in which nuclei are imbedded. Some of these nuclei are arranged longitudinally, others transversely to the axis of the vessels. In the growth of these vessels changes occur, answering to those seen in ordinary embryonic development.

SKIN GRAFTING.

When the *cutis vera* is extensively destroyed and the healing is slow, the process of skin grafting or transplanting cuticle may be resorted to. The process is based upon the law that cuticle can only be produced by skin; the power of skin to set new cuticle growing from its edge so as to cover over a wide surface being limited.

In a very large ulcer which has ceased to heal, new centres of cicatrization may be established, by taking little pieces of skin about the size of a millet seed, including the cuticle and the thinnest possible layer of cutis from the inner side of the upper arm, and planting them flat, at the distance of three-quarters of an inch, upon the raw surface among the granulations of the wound or ulcer, covering and retaining them in position by the ichthyocolly plaster, which has been moistened by a solution of bichloride of mercury 1 : 1000.

The dressings must be allowed to remain four or five days, when the grafts will be found to be firmly attached.

If the grafts are very small, they may be so completely embedded and hidden in the granulations as to be quite invisible for a short time, but in three or four days each point will be seen to have become a little white islet of cicatrix, from whence the growth of cuticle spreads.

Thiersch's Method consists in using actual portions of skin and covering the whole surface of the sore at the same time.

The surface must be first thoroughly purified and washed with normal salt solution (sodii bicarb., sodii chlor., each three-tenths per cent.) and compresses of the same fluid laid over the wound until the strips are ready. The part from whence the skin is obtained (preferably the arm or thigh) must be thoroughly scrubbed with a solution of corrosive sublimate, or iodide of mercury in iodide of potash; then the antiseptic is washed away with the salt solution, and long strips of skin are cut off with a sharp razor, as wide as the parts will allow. The limb from whence the strips are obtained must be held firmly from beneath with one hand, so as to put the skin upon the stretch, and a shaving as long as thought advisable is quickly taken from the upper surface. Subcutaneous fat should not be included, but the whole thickness of the true skin is necessary. Strip after strip obtained in this way is placed on the raw surface and pressed firmly into position until the whole is covered. A layer of protective perforated with numerous large openings is placed upon the part, and over this compresses wet with the salt solution, which must be changed daily.

GANGRENE.

Gangrene is the death of any part of the body in consequence of disease or injury.

Gangrene is divided into moist and dry.

Of the moist gangrene there are two varieties: Localized traumatic gangrene, and traumatic spreading gangrene.

The causes of moist gangrene are predisposing or exciting.

The *predisposing causes* are defective nervous power, as in palsied limbs, or division of large nerve-trunks; general debility, from poor food and improper nourishment; use of alcoholic drinks; debilitating diseases; atheromatous changes in the arteries of old people.

The *exciting causes* are produced by whatever interferes with or arrests the circulation of a part; these may be divided into—

1st. *When there is an arrest of the supply of arterial blood to a part*, which may be produced by accident, or by ligature or other surgical operation, or by thrombosis or embolism of the arteries.

2d. *When there is obstruction of the circulation through a part:* this may arise from pressure either from within, or from the growth of a tumor; or from without, as the formation of bedsores. Obstruction to the capillary circulation necessarily accompanies all acute inflammations, and forms an important element in the production of gangrene.

3d. *Obstruction to the return of venous blood to a part.* This is seldom the sole cause of gangrene, even when important veins are occluded by thrombosis or pressure.

4th. *Extreme weakness of the heart's action.* This is a powerful accessory cause when there is any obstruction, either to the arterial flow or to the venous return.

Finally, *Whatever destroys the cells of a part*, as injuries, applications of chemical agents, effusion of putrid fluid, absorption of putrid matter, prolonged use of mercury, excess of heat or cold.

The Local Symptoms of Localized Traumatic Gangrene.—At the beginning of the attack there is usually pain and tenderness of the part, which becomes very acute and lancinating; it is of a severe burning character; there is increased local heat; the discoloration, which is at first of a vivid red, is changed to a deep purple or black, with here and there greenish spots. The part becomes greatly swollen, soft, and soggy, from the formation underneath of fluids and the gases of decomposition; the epidermis is elevated in blisters.

When the part is dead the pain and tenderness cease, it becomes cold, the bright redness disappears, and a sickening, fetid smell is exhaled.

When the progress of the disease is arrested, a healthy circulation is established up to the margin of the mortified part, and the *line of demarcation* separates the living from the dead tissue.

Treatment.—To avert threatened gangrene, the patient, if young and robust, with a full, hard pulse, should be purged, and arterial sedatives should then be administered, which will allay pain and tranquillize the heart's action. If there is a great deal of inflammation with effusion, free incisions should be made into the part, and antiseptic dressings applied.

The timely use of a blister over the entire surface will sometimes bring about healthy action, and set aside the tendency to gangrene.

When gangrene has been fairly established, tonics, such as iron, quinine, strychnia, together with a nutritious diet, should be prescribed, and stimulants must be resorted to if necessary.

The limb should be put in an aseptic condition; it should be thoroughly washed with 1-1000 solution of corrosive sublimate, care being taken not to abrade the skin; after this wrap the limb in iodoform cotton-wool, so as to invite the flow of blood to it, or place over the part wool that has been impregnated with 1-1000 solution of corrosive sublimate; confine it by a roller, and keep the limb elevated and at rest. The part should be dressed at least twice a day.

To allay fetor, permanganate of potassium, carbolic acid, and the chlorides must be resorted to.

Cleanliness and thorough ventilation of the apartments must be insisted upon.

Local Symptoms of Spreading Traumatic Gangrene.—In this variety the disease spreads hour by hour with alarming rapidity. The color is characteristic and striking, described by Professor Keen as of a "deep bronze hue, like the rind of bacon." The part is hard and brawny, the limb becomes swollen, and the gases of putrefaction are evolved, giving it a crackling sensation. These gases are hydrogen, nitrogen, and hydrogen sulphide.

Constitutional symptoms are of a septicæmic type, commencing with chill, followed by fever, sweating, rapid emaciation and exhaustion.

Treatment.—The recognized treatment is amputation, to be used at once, not waiting for the line of demarcation to take place. The point of selection must be as far as possible from the seat of disease. At the same time free stimulation must be employed, and should consist of such articles as brandy, whisky, quinine, iron, and strychnia. If there be much sweating camphoric acid should be administered. The patient should be isolated and carefully nursed by trained attendants.

Dry Gangrene, Senile Gangrene.

Symptoms.—The want of a due supply of arterial blood in these cases is owing not only to the diseased state of the arteries, but also, in a great measure, to the weak propulsive power of the heart, and consequent feebleness of the circulation, especially through the lower limbs. When the circulation is sufficiently interrupted to lower the nutrition of the limb, a sensation of weight in the part, with coldness, itching and tingling of the feet, and cramps of the calves are complained of. These symptoms exist for some time before gangrene comes on.

The disease may commence in different ways. In many cases it begins without any apparent exciting cause.

There may be coldness of the extremities, numbness and tingling; on examination, a small dark or purplish spot will be found on the inside of one of the toes, not larger than a mustard seed. This is succeeded by a vesicle, which exposes a black surface on bursting. This gradually spreads until the whole foot is involved, traveling up as high as the ankle. It may begin on several toes simultaneously, or it may show itself on the instep or heel. The part destroyed becomes black, dry, withered, cold, insensible, resembling in appearance the limb of a mummy; hence the change is often called *mummification.*

The constitutional symptoms vary. In the inflammatory form there is considerable general disturbance, with elevation of temperature at first, afterward sinking into marked depression, and the disease may prove fatal in a few weeks. In the dry form of gangrene the disease may continue, with very little constitutional derangement, for a length of time. In all forms of spontaneous gangrene there is a marked improvement in the general health of the patient as soon as a distinct line of demarcation forms between the dead and living tissue. In old people diabetes is a fertile cause of gangrene of the toes and feet.

Treatment.—It is only before the occurrence and during the spread of gangrene that the use of lowering remedies can be suggested. The constitutional conditions which predispose to gangrene, such as want of food, diabetes, fever, feebleness of the heart's action, are all associated with debility; consequently, depressing remedies are to be avoided. Tonics, together with stimulants such as are recommended in acute gangrene, should early be had recourse to; if there be much depression, ether, ammonia, and camphor are of material service. The administration of opium, in doses of from two to four grains during twenty-four hours, in cases where the drug does not disagree with the patient, is recommended by all authorities.

Locally, salicylic wool, or iodoform wool, or simple cotton wool, in thick layers around the foot and limb, covered with a silk handkerchief or thick stocking, must be used. The gangrenous part may be powdered with iodoform or left dry beneath the cotton wool.

Question of Amputation.—When the gangrene is the result of a severe injury, when it is rapidly spreading, or when it arises from a wound or ligature of an artery, the rule is to amputate at once. The operation should be performed as soon as the gangrene has manifested itself, without waiting for the line of demarcation.

In chronic gangrene, due to diabetes, or senile gangrene, due to embolism, amputate without delay, not waiting for the line of demarcation to present itself; when it is due to ergotism, do not amputate until the line of demarcation is distinct; in the first case amputate as far from the seat of disease as practicable; in the second case amputate near to the line of demarcation. Examine the urine for sugar, so as to determine the necessary course of treatment.

But even after the line of demarcation is formed, the surgeon must be well assured that the patient has vigor enough to bear the loss of blood that must necessarily ensue, before resorting to amputation.

If the mortification is local as to its cause, it will be proper to amputate just above the injured part, as, for instance, where there is mortification of the limb from severe compound fracture, or from injury of one of the large arterial trunks.

Exemplifications.—If an individual have molten iron come in contact with one of his extremities, causing disintegration of the part, amputate at the most convenient point.

If a person have his lower limb run over by a railway car and acute inflammation, followed by gangrene, sets in, amputate.

Whenever acute gangrene depends upon the obstruction of the main artery of a limb, unless the embolism be situated high up, amputate.

In all cases of traumatic gangrene, when the process is sure to spread rapidly, amputate.

In cases of frostbite, or burn, wait for the line of demarcation, and then amputate as nearly as possible to the seat of injury.

Hospital gangrene is a severe ulceration, in which there is copious exudation and infiltration of the affected part, together with rapid decomposition; it arises where a number of sick and wounded men are crowded in ill-ventilated apartments, who are deprived of nourishing food, and where there is no opportunity for separating the infected. It may affect any kind of a wound, or even a mere bruise.

Hospital gangrene may be divided into idiopathic and traumatic; it is idiopathic when it depends upon constitutional causes, and traumatic when it has its origin in an external injury.

Symptoms.—When the disease ensues from a wound, an ulcer, or on the stump of an amputated limb, the part begins to be painful, the edges inflame, the suppuration becomes less and of a serous character, the granulations assume a dark and foul appearance, and are rapidly destroyed; a quantity of lymph, of a grayish appearance, covers the sore; the wound increases in all directions; the edges become painful and œdematous, and the œdema spreads. The disease begins with pain, which is constant and excessive, being sharp and stinging; cavities are observed more or less deep, the edges being covered with pus. These ulcerous spots increase and run together; a bloody, ichorous fluid is secreted, and the surface enlarges in all directions. The destruction is often restricted to the cellular tissue, but frequently the muscles and all surrounding parts are destroyed.

Bleeding sometimes occurs from the destroyed vessels. When suppuration takes place, the discharge is abundant and highly fetid.

These local symptoms are accompanied by loss of appetite, pain in the region of the stomach, nausea, costiveness, loss of sleep, quick and generally a weak pulse, hot skin, anxiety, and restlessness.

Its characteristic is quick extension and decomposition of the tissues.

The contagion develops itself usually in hospitals, where the air is deteriorated, where patients are huddled together, and where attention to cleanliness is not observed.

When the disease begins as a local affection, it commences as a vesicle, surrounded by dusky inflammation, with severe darting and stinging pains. When the pustule is ruptured, the ulcer displays a dirty, foul slough. The sore soon enlarges; the edges become everted, and the parts puffy and swollen; the surface is composed of gray or ash-colored sloughs, which may become brown, or resemble coagula of blood. These symptoms are accompanied by loss of sleep and exhausting diarrhœa, which, if continued, end in death in about three weeks.

Treatment.—As soon as the patient is seen he must be at once isolated, and, if it be possible, a special nurse should be assigned to the case, and at the same time the strictest hygienic precautions enjoined. It is proper to commence with a free purge; a mercurial purge is to be preferred. During the course of the disease the bowels should be kept in a soluble condition.

When the patient begins to show evidence of flagging, tonics, in the shape of iron, quinine, strychnine in doses of one-twentieth of a grain, together with wine, brandy, milk, nutritious broths, should be had recourse to. Muriated tincture of iron, in doses of twenty drops every three or four hours, is probably the best ferruginous preparation. To allay pain and irritability and produce sleep, opium should be administered in large doses.

The diet should be highly nutritious, and if there is evidence of a scorbutic taint, oranges, lemon juice, potatoes, onions, tomatoes, etc., must be freely given.

The **local treatment** should be soothing; the exposed surface should be thoroughly cleansed and dried, and the parts freely bathed with a weak solution of acid nitrate of mercury, carbolic acid, nitric acid, sulphate of copper, etc., etc. The application of chloride of zinc or nitric acid should be followed by a moist dressing of bichloride of mercury, to which is to be added a solution of permanganate of potash.

Great care must be taken, not only to keep the parts clean, but everything surrounding the patient must be constantly cleansed, and changes in the dressing should be frequently made.

Bromine, permanganate of potassium, chloride of zinc, chlorinated sodium, creasote, nitrate of silver, etc., all have their advocates, and may be used in turn. Sloughs should be cut away.

SEPTICÆMIA.

Septicæmia is an infective disorder which is produced by the absorption of septic microörganisms and their ptomaînes, generated in an open wound or by inflammation. There are two varieties: septic intoxication and septic infection.

The first variety, or septic intoxication, is most commonly met with in obstetrical cases where a clot of blood or a portion of the retained placenta becomes putrid; or in operations upon the abdominal cavity; and occasionally in large, badly drained wounds.

There being no microörganisms found in the blood, this ailment is supposed to be due to the absorption of chemical poisons, presumed to be ptomaînes.

The symptoms are those of an alkaloid poison and will vary with the amount of substance absorbed. A severe case will begin with unaccountable restlessness; a rigor or chill sometimes takes place, followed by a marked rise of temperature, nausea, vomiting, diarrhœa, delirium, followed by coma, ending in death. In milder cases there will simply be restlessness and fever, the intensity of the symptoms varying with the amount of poison absorbed.

Internally the main dependence is to be placed on whisky or brandy, hence free stimulation should be resorted to. Quinine, iron, strychnine, and anodynes if required, should be employed. Vomiting is best controlled by very hot water, or a four per cent. solution of cocaine in five-drop doses.

The second variety, or septic infection, is due to absorption of the ptomaïnes and the bacilli and micrococci in the blood, and their proliferation.

This variety usually makes its appearance about the third or fourth day after the injury; it begins with a chill, followed by a continued fever of the typhoid type. There is a perceptible increase of temperature in the evening, with profuse and exhaustive sweats, accompanied by vomiting and diarrhœa; the stools are dark, tarry, and offensive. The skin is hot and dry or clammy. The tongue is covered with a thick, dry, brown coat; the urine is scanty; toward the close delirium and coma supervene, when the case terminates in death. On examination after death the blood is found to be liquid and dark, with extravasation into the serous membranes; there is frequently cloudy swelling of the liver and kidney, with marked enlargement of the lymphatics and spleen.

Treatment.—Every effort should be made to secure an antiseptic condition of the wound. The internal treatment is the same as that laid down in the first variety.

PYÆMIA.

Pyæmia differs from Septicæmia in this respect, that the absorption and dissemination of the poison give rise not only to a general disease, but also cause the formation of secondary foci of inflammation—the so-called *metastatic abscesses;* that is to say, pyæmia is septicæmia combined with the formation of abscesses. The abscesses are called secondary, because they are secondary to a primary inflammation. They are called embolic, because they originate from emboli. They vary in size from a seed to a large walnut; they are generally found in the lungs, liver, spleen, kidneys, and brain, and are usually upon the surface of organs.

The **symptoms of pyæmia** present themselves within the first week after putrid or septic changes have begun in a putrid part; they are ushered in by a severe rigor, followed by profuse sweating. The temperature will vary from 103° to 105°. The skin will be dry, tongue coated, attended by sordes on the gums and teeth; the countenance will become jaundiced; there will be nausea, diarrhœa, and all the symptoms of asthenic fever. There will be dull, heavy pain in the part where the abscess is forming. If the abscess is forming in any of the external tissues of the body, it will be known by fluctuation.

Prognosis.—Serious; usually fatal. Repeated shivering is the very worst omen. A temperature of or above 106° is very unfavorable.

The **treatment** of putrid or septic intoxication, septicæmia and pyæmia is identical. These affections depend upon the entrance into the blood of putrid or septic materials, and there must be a point from which this material is derived; hence the wound must be rendered aseptic.

Lay open the abscess, wash it out with antiseptic solutions, and dress it with antiseptic dressings. Give opium to relieve pain if necessary.

The indications are to remove the exciting cause of the disease, by rendering the wound antiseptic, and by keeping up the strength of the patient.

It may be well to begin with a calomel purge, when general indications warrant it. The attention of the surgeon should at once be turned to the necessity of keeping up the strength of his patient, and tonic treatment should be early resorted to. Quinine, with or without iron, should be administered. When suppuration is established Huxham's tincture of bark and aromatic sulphuric acid are the remedies, and sleep must be procured by opiates. Brandy or whisky, port or sherry wine, beef tea, milk, eggs, and such articles as will keep up the strength of the patient, are early indicated. Alcoholic drinks, pushed to slight intoxication, are chiefly to be relied upon.

Cleanliness must be insisted upon, and great good will be attained by diligent and unfailing attention to the dressings.

Detergent lotions containing chlorinated sodium, carbolic acid, or chloride of zinc are serviceable.

The position of the part should be so arranged as to favor the escape of the secretions, the wound kept freely drained.

Should hemorrhage exist, muriated tincture of iron is a remedy to be resorted to; it should be given in doses of 20 to 30 drops, every four hours. Ergot or atropia, combined with the iron or given separately, will be found valuable in allaying the copious sweating that is apt to exist in this disease. The most reliable remedy is believed to be camphoric acid.

ANÆSTHESIA.

Anæsthetics are those agents which are employed for the prevention of pain, especially when used in surgical practice and during labor. They are likewise used to produce relaxation of muscles, when needed in reducing dislocations and hernia, or in setting fractured bones. They may be also resorted to in making diagnoses in cases of obscure abdominal tumors and in supposed malingering.

Anæsthesia may be produced by benumbing the part to be operated on by means of cold, by intercepting nervous communication, and by arresting the activity of the nervous centres concerned in sensation. They may be either local or general in their action.

Local Anæsthesia.—When anæsthesia is to be induced by cold, the most convenient plan is to throw a jet of anhydrous ether spray upon the part, and thus freeze it; or a mixture of equal parts of pounded ice and common salt, contained in a bag, may be applied to the part; or chloride of ethyl may be used.

Muriate of cocaine, in four per cent. solution, produces complete local anæsthesia of mucous surfaces. Two or three applications at intervals of five minutes will, in about ten minutes, produce local anæsthesia of the part to which it is applied, and will last for a quarter of an hour. When it is desired to be employed in cases of amputation of fingers, or in removal of tumors, a solution of four per cent. strength should be injected into different parts of the affected organ in quantities of ten minims. If there be any affection of the heart cocaine must not be used.

General anæsthesia is obtained by inhalation.

Should the patient be debilitated, or should he be suffering from heart disease, it is well to administer hypodermatically a mixture of sulphate of morphia, gr. ⅙; whisky, ♏xx, half an hour before administering the anæsthetic.

Before commencing inhalation, the patient should have abstained from eating for at least four hours; it is important that the stomach be empty at the time that an anæsthetic is administered, vomiting being almost sure to occur if the stomach contain food. He should lie comfortably in the horizontal posture, and the dress should be loose, especially about the neck and abdomen. If the vapor excites either swallowing or coughing, its strength must be diminished. After volition has been suspended, any pause in the breathing should be noted and fresh air be given.

The agents chiefly in use in producing general anæsthesia are nitrous oxide, ether, and chloroform.

Protoxide of Nitrogen—Nitrous Oxide.—This is the safest anæsthetic to give and the most pleasant to inhale. It is of the utmost importance to exclude all air when administering this gas.

In order to do this a proper apparatus with a closely fitting face-piece to cover the mouth and nose must be used. The gas is supplied for use compressed in iron bottles. The bottle is connected with the face-piece by a tube, in the middle of which is an India-rubber bag. After the face-piece has been firmly applied to the patient's face, the bag is distended with gas by turning the stopcock connected with the iron bottle, and the patient, breathing backward and forward into the bag, inhales the same gas several times. The patient should be instructed to breathe slowly and deeply, and be shown how to do so; he should inhale about fifteen times a minute.

After inhaling for about one minute the breathing will be stertorous or interrupted, the pulse will be feeble, and there will be convulsive twitchings when total anæsthesia is established; until this condition pertain, the face-piece should not be removed.

Ether, sulphuric ether, ethylic ether, or **oxide of ethyl** may be administered from a towel or hollow sponge; the towel or napkin is arranged so as to form a hollow cone, thus lessening the admission of fresh air. Should an inhaler be preferred, the apparatus of Dr. Oscar H. Allis is recommended. As a rule, while anæsthesia is being induced, an inspiration of fresh air should be allowed every half minute; and after it has been effected, every three or four inspirations from the inhaler should be followed by one of air.

If, at the commencement of the administration, the patient shows signs of intolerance, by swallowing or coughing, it is advisable to admit one inspiration of air.

When deep snoring takes place, it is the indication of complete anæsthesia. A much smaller quantity of ether is required to maintain than to produce anæsthesia. Any disturbance of the pulse or respiration, will, as a rule, be remedied by diminishing or discontinuing the vapor.

Chloroform.—The general method of administering chloroform is by means of a handkerchief or towel folded into a cone, open at the apex, so as to admit air at the same time that the chloroform is inhaled, into which a drachm of the fluid should be poured, to be renewed from time to time in quantities of fifteen minims; or a piece of lint, about twelve by six inches, folded so as to form a square of about six inches, may be used, on which the chloroform may be sprinkled from a small drop bottle; in a few seconds a little more may be added; the quantity should be increased slightly each time, taking care that the part of the lint which is wet with the anæsthetic does not touch the face.

The movement of swallowing should be looked for, and regarded as an evidence that the vapor is stronger than necessary. If hiccough should supervene, the chloroform should be withdrawn. The pulse frequently gives the first warning of approaching danger, and is, therefore, to be carefully watched; if it flags, or should it become feeble, irregular, or intermittent, the chloroform must be immediately stopped; or if it appears that the amount of the anæsthetic in the air passages is excessive, not a moment should be lost in seizing the tongue with the forceps—with which the administrator must always be provided—dragging it out of the mouth, and sponging out the fauces; should this not result beneficially, artificial respiration should be resorted to, or if the entrance of air be still obstructed, tracheotomy must be performed without delay.

Directly any stertorous noise is heard a breath or two of fresh air should be allowed, and no more chloroform administered until the pulse beats well and the respiration is free.

If a severe operation is about to be performed, the chloroform should be given in the same general manner as in a slight one, but continued to the point of fixing the pupils and producing stertorous breathing; and when the chief shock of the operation is expected, two or three breaths of pure air should be admitted, so that if the pulse fails there may not be an excessive amount of chloroform vapor in the lungs.

Directions for restoring animation in cases of extreme syncope:— Remove the pillow from beneath the patient's head, seize the tongue with the forceps and draw it forward; compress the sternum forcibly, allowing the chest of its own elasticity to expand; do not wait for the respiration to cease before doing this. At the same time let one of the assistants administer a hypodermic injection of fifteen minims of tincture of digitalis. If the symptoms of heart failure continue, give another hypodermic of aqua ammonia, ♏v; whisky, ♏xx. If there be symptoms of failure of respiration, administer hypodermatically one-sixtieth of a grain of atropia.

If, after two or three compressions, there is any improvement, continue the treatment; place one hand on the back and the other on the sternum, and keep up the respiration by pressure, having previously suspended the patient by his legs, with his head downward.

If this does not succeed, try Howard's plan; see directions under **Chest Pressure** and **Faradization.**

SURGICAL BACTERIOLOGY.

The microörganisms which give rise to surgical diseases belong to the lowest forms of vegetable life; they are classified under the name of *Schizomycetes*, which includes the *Bacillus*, the *Micrococcus*, and the *Spirillum*.

The bacilli are rod-shaped bodies whose spores show a remarkable resistance to heat, drying, and chemical reagents. Blood containing them may be kept for years in the dry state, yet when moistened they will be found not to have lost their vitality.

The micrococci are round organisms varying from $\frac{1}{2500}$ to $\frac{1}{10000}$ of an inch in diameter. Their mode of reproduction is by cell division.

The spirilli are the spiral forms; an example of which is found in the comma bacillus of cholera.

Microbic life is found everywhere; in the air, in the water, and in the earth. Far out at sea and in high altitudes they are few in number.

Each variety flourishes best in its appropriate temperature; the majority thrive most abundantly at or about the normal temperature of the body. Cold suspends their activity but fails to destroy them, whilst heat at the temperature of from 165° to 212° effectually eradicates the germs.

Some forms of bacteria require the presence of oxygen to develop their activity, whilst others are only active when this gas is absent. Those which flourish best in presence of oxygen are known as aërobic, and those which live without oxygen are denominated anaërobic. The former are by far the more numerous. An example of the latter variety is to be met with in the bacillus of tetanus.

Microörganisms are divided into pathogenic and non-pathogenic. The pathogenic microbes are those which produce specific diseases, such as the streptococcus of erysipelas, bacillus of tuberculosis, bacillus of tetanus, etc., etc. The non-pathogenic are by far the most numerous; they are perfectly harmless to the human organism; an example of the non-pathogenic is found in the sarcina-ventriculæ, found in the human stomach. They are supposed to aid in digestion.

Microbes gain access to the body through the medium of the respiratory system, the alimentary canal, and by means of wounds or abrasions. They are eliminated precisely as any effete material is; by the medium of the skin, lungs, kidneys, or bowels.

Tissues are endowed with what is called "normal powers of resistance," by which is meant that in a perfectly healthy condition they are enabled to resist the invasion of microbes, but when an organ is weakened by disease or injury, or by inherited tendency, the germs find a suitable soil for their nidus and growth, each producing disease according to its kind. The body is protected by the action of the phagocytes, "which are the leucocytes present in large numbers in inflammatory conditions, which have the power of attacking the invading bacteria and taking them into their protoplasm."

Those microbes which find a suitable soil for their growth in dead organic substances are called saprophytic; during the process of decomposition very powerful poisons, known as ptomaïnes are developed in the presence of saprophytic bacteria; they resemble alkaloids in their physiological action. Leucomaïnes are likewise alkaloid substances produced by the action of bacteria upon albuminous material, but only during the life of an animal producing such material.

Classification.—The micrococci when arranged in rows or chains are called streptococci, when bunched together in grape-like masses they are denominated staphylococci, when found singly they are known as monococci, when in pairs diplococci, and when in masses they are known as zoogloea.

The bacteria of putrefaction are denominated bacteria termo. They are minute rod-like bodies, their length being twice their width. They are found in all putrefying solutions and mixtures of organic matter. They are frequently present in the healthy body, but are quite harmless as long as the tissue which they inhabit is endowed with life.

The pus-producing microbes are known as pyogenic bacteria; their power to produce pus lies in their ability to liquefy the fibrinous exudate of inflammation.

The microörganisms that produce pus are: 1 Staphylococcus pyogenes auris (which is most frequently present in acute abscesses); 2 staphylococcus pyogenes albus; 3 staphylococcus pyogenes citrus; 4 staphylococcus cereus albus; 5 staphylococcus flavus; 6 stapyhlococcus flavescens; 7 micrococcus pyogenes tenuis; 8 streptococcus pyogenes; 9 bacillus pyogenes fœtidus; 10 bacillus pyocyaneus.

Table giving the Strength of Antiseptic Solutions, and the Length of Time required to kill Microbic Life, with each.

Bichloride of Mercury	1:500	Ten seconds.
" "	1:1000	Forty-five seconds.
" "	1:2000	One minute.
" "	1:5000	Three minutes.
" "	1:10,000	Five minutes.
Carbolic Acid	1:20	Fifteen seconds
" "	1:40	Thirty to sixty seconds.

Iodoform retards germ growth after an exposure of twelve hours.

Water at the temperature of from 165° to 212° destroys germs on contact.

ASEPSIS AND ANTISEPSIS.

Directions for the Preparation of Surgeon, his Assistants and Attendants. Rules for the Preparation of the Room and Instruments. Necessary Materials to be used during a Surgical Operation.

Aseptic surgery is the method where heat or chemical antiseptics, or both, are used for the purpose of obtaining absolute surgical cleanliness; after this has been accomplished only such solutions, dressings, etc., are used as have been sterilized and made germ-free by heat.

This form of operative surgery can only be successfully carried out where an "operation of deliberation" is contemplated, and where the operator has the time and means to prepare the patient, his assistants, and all the paraphernalia needed during the operation; as when the abdominal cavity is to be opened.

In the **antiseptic** method the same antiseptics are used for procuring cleanliness, and in addition, chemical solutions, and dressings impregnated with them, are used during and after the operations.

The following are the general directions to be observed: Before undertaking an operation of any moment, the surgeon should see that the room to be occupied by the patient is properly prepared; with this object in view every article not absolutely needed should be removed; the carpets should be taken up;

the floor scrubbed and then washed with bichloride solution (1–1000); curtains should be taken down; upholstered sofas and chairs replaced by those made of wood alone, etc. etc.

The day before an operation is to be undertaken the parts should be shaved, washed with soap and water, then with ether or alcohol, and finally with sublimate solution 1 : 1000, or if necessary 1 : 500.

A sublimate gauze dressing must then be applied, and retained in place by bandages, where it is to remain till the operation is about to be performed.

Especial care must be taken to thoroughly clean the genitals, armpits, navel, etc. When operations are to be performed on the head the entire scalp should be shaved. Patients who are begrimed by dirt, oil or grease should have the parts first well rubbed with sweet oil and then washed with soap and water, or Johnson's Ethereal Soap.

To prevent the patient from touching the part to be operated upon the arms and legs should be wrapped in bichloride or sterilized sheets or towels, during and for some time prior to the commencement of the operation.

The principal antiseptics in surgical use are bichloride of mercury, biniodide of mercury, hydronaphthol, peroxide of hydrogen, carbolic acid, alcohol, chlorine, boric acid, and tannic acid. Carbolic acid is used in solutions of 1 : 20 to 1 : 40, and bichloride of mercury internally in solution in 1 : 5000 for the irrigation of joints; 1 : 10,000 for the peritoneal cavity, and externally in from 1 : 1000 to 1 : 4000.

In the peritoneal cavity boiled water is used.

Before the operation begins the hands and forearms of every one who is to come in contact with the case must be thoroughly washed with hot water and soap, and rubbed with the nail brush for several minutes; then scrubbed in 1 : 1000 solution of bichloride of mercury. The surgeon should be in his shirt sleeves, with the sleeves pinned well up above the elbow. He and his assistants should wear either white linen coats or white aprons, or should be protected by a carefully prepared sheet so folded as to be about five or six feet long, and at least two feet wide.

Should the operator sweat profusely he should tie a towel around the forehead and head, so as to absorb all the fluid. Especially should this precaution be taken if the abdominal cavity be the seat of operation. To wipe the hands, when necessary, a sterilized towel must be used. The nurse should wear white muslin, or some other wash goods.

The chief source of infection, during an operation, are the hands of the surgeon and his assistants, instruments not properly disinfected, sponges and dressings.

During the washing the nails must be thoroughly cleaned by scraping with penknife or nail cleaner. The nail brush should be always kept in 1 : 40 carbolic solution or in 1 : 1000 sublimate solution.

The usual method of disinfecting the hands is the following: The forearms and hands having been cleaned they are dipped in absolute alcohol for one minute or longer, then plunged in hot sublimate solution 1 : 1000 and afterward scrubbed with a nail brush. Whenever the hands or forearms touch any object which has not been disinfected they should be immediately again washed in bichloride solution.

Another method is by means of potassium permanganate and oxalic acid solution. The hands and forearms are thoroughly cleansed, then immersed in a solution of permanganate of potassium, and afterward immersed in a saturated solution of oxalic acid. The oxalic acid should be washed off in warm sterilized water.

The instruments should be boiled for ten minutes in a one per cent. solution of sodium carbonate. They should then be rinsed in a 1 : 20 solution of carbolic acid and placed on trays in water which has been boiled and allowed to cool. The instruments whenever used should be recleansed by a nurse with aseptic hands and replaced on the tray. When the operation is finished the instruments should be carefully scrubbed with a nail brush and then carefully dried.

For the method of preparing sponges see Formula 82.

Mops of sterilized gauze or antiseptic gauze are now generally used instead of sponges, which have been practically abandoned by many surgeons. The abdominal gauze pads devised by Professor Ashton are usually about eight or ten inches square. They are made of a number of folds of the ordinary gauze, loosely hemmed, then sterilized or made antiseptic by sublimate solution.

Dressings must be prepared and laid on clean bichloride towels before commencing an operation.

During the operation the parts should be frequently irrigated with bichloride solution.

One of the most important features of antiseptic surgery is drainage, which must be most carefully provided for when the wound is about to be closed. Professor Keen prefers double drainage by means of rubber tubes and a *fasciculus* of horsehair. Then a sufficient quantity of bichloride gauze should be placed loosely about the wound to allow of easy percolation of serum, and put over it some material that will cause the discharge to diffuse itself through the dressings. India rubber, oiled silk or waxed paper may be used. Over the impermeable material, jute, wood wool, oakum or iodoform absorbent cotton must be applied, so as to take up any percolating discharge.

When double drainage is employed, the tube is to be withdrawn at the end of twenty-four hours; at the same time the antiseptic dressings must be changed and the saturated gauze removed. The part must then be carefully redressed, and allowed to remain unmolested until the end of the fourth day, when the horsehair is to be removed and a clean dressing applied. After the tube is removed the drainage is carried on by capillary attraction. The stitches may be taken away by the seventh or eighth day. Catgut is employed to drain serum; its ends must be kept moist, to insure drainage. The rubber tube must be perforated with holes at the distance of a quarter of an inch; the ends pared off close to the surface, and kept in place by a stitch or pin.

The usual indications for changing dressings before the wound heals, are—when rubber drainage tubes need to be removed; when secondary hemorrhage occurs; when, the operation not having been done antiseptically, there is evidence of increased temperature; when plastic operations and other supplementary work are to be done.

Should it become necessary to remove the dressings, it must be done with disinfected hands; the new dressing being carefully prepared, using bichloride towels.

Iodoform is used only on suppurating or putrid wounds, or in tuberculous cases.

If on the day following the operation the patient's temperature should rise to 102° F., accompanied by a full and hard pulse, a saline cathartic should be administered, and in addition, tincture of aconite in doses of three drops every three hours must be given, until the pulse changes; if the temperature reach 102° F., on the second day after an operation, it would be advisable to change the dressing and examine the wound.

Tissue which is likely to slough should be trimmed away before closing the wound. All bleeding from the small vessels should be effectually attended to before closing the wound, and all clots must be removed.

Previous to commencing an operation the following must be made ready:—

A rubber sheet, one of the most necessary articles, must be six feet long; it must be wetted with the bichloride solution, and is to be placed under the patient and so arranged that fluids will run into the pail below; wet bichloride towels may be substituted for the rubber sheet.

The irrigator, filled with 1–1000 bichloride of mercury solution. A large dish filled with 1–1000 bichloride solution for washing sponges. A dish filled with 1–30 carbolic acid solution for instruments.

A wide-mouthed bottle containing No. 8 and No. 7 catgut in alcohol; a bottle of chromic catgut; a wide-mouthed bottle with Lister's protective, in 1–30 carbolic acid solution; iodoform.

Bichloride gauze; wood wool or jute; bichloride cotton.

A skein of catgut in a saucer of 1–1000 bichloride solution; bichloride-gauze bandages.

Razor; nail-brush; prepared sponges; alcohol and bandages; one hand-basin; one basin for sponges; one basin for 1–1000 bichloride solution; one basin for dressings; one basin for bichloride towels (dry); one small basin for alcohol; one bowl for ligatures; one bucket to receive discharges; one syringe; pins; pitcher for hot distilled water; pitcher for cold distilled water.

For modes of preparing the various antiseptic solutions, see formulæ at the end of the volume.

HEMORRHAGE.

Hemorrhage is either arterial, venous or capillary.

Arterial hemorrhage is known by its bright crimson or vermilion tint, and by its issuing from the divided vessels in jets, synchronously with the contraction of the left ventricle.

In *venous hemorrhage* the blood is of a dark-blue tint, and flows from the divided vessel in a continuous stream.

In *capillary hemorrhage* the blood is of a reddish tint, and exudes from the tissues; in other words, there is a welling up.

Subcutaneous hemorrhage, also called diffused aneurysm, exists where there is no external flow of blood, either from want of parallelism of the wound in the vessel and the open wound in the tissue, or from the rupture of a vessel by a blow, or otherwise, subcutaneously.

Effects of Hemorrhage.—When a large vessel is divided, or a large number of small ones, death may take place at once. Usually the patient is seized with syncope, after the wound has been bleeding for some time, when the heart's action becomes more depressed, and, the blood becoming more coagulated, nature is given an opportunity to form a clot within and around the artery. After a time reaction takes place, when there is danger of a recurrence of the bleeding, and of the patient dying from exhaustion.

Treatment of the Effects of Primary Hemorrhage.—Put the finger over each divided extremity of the vessel, or apply a provisional tourniquet; place the patient in the recumbent posture, with the head lower than the body. Compress both axillary arteries and both femorals, so as to divert the flow of blood to the brain. Apply external heat, by means of bottles of hot water, warm blankets, etc. etc.

Stimulate the heart's action by a hypodermic of morphia, gr. $\frac{1}{4}$, atropia, gr. $\frac{1}{100}$, or a hypodermic of digitalis or ether. As soon as reaction takes place, resort to means to effect a permanent arrest of hemorrhage.

The reaction which follows upon a copious loss of blood is *generally attended by hemorrhagic fever*, the pulse being frequent, soft, and jerky; heart fluttering and tremulous; eyes suffused; skin hot and dry; countenance flushed; headache, nausea, and possibly vomiting, accompanied by wandering of the mind. The proper treatment for this condition is rest, exclusion of light, and give every four hours morphia, gr. 1/6; neutral mixture, half-ounce; apply ice-bags to the head; sponge the surface with an evaporating lotion, administer beef extract, koumiss, brandy, milk in small quantities and at regular intervals. See Formulæ 54 and 57.

When there is collapse from the loss of blood, a saline injection (one drachm of common salt to a pint of water) introduced under the skin in the region of the outside of the thigh, or the buttock, by means of an aspirator, has frequently saved life.

When the hemorrhage takes place in a cavity, in consequence of the bleeding from one of the abdominal viscera or from the lungs, the patient should be given, every four hours, either three grains of gallic acid or two grains of acetate of lead, with one grain each of powdered digitalis and ergotine, together with half a grain of opium.

These remedies sustain the action of the heart, produce contraction of the blood-vessels, and render the blood more plastic; hence, they are of great utility when the blood-vessel cannot be reached.

Consecutive or Recurrent Hemorrhage comes on in about twenty-four hours after an operation; it is generally due to a faulty application of the ligature, including a nerve in the ligature, by the application of Esmarch's bandage, or to the reaction which takes place after a shock.

The proper treatment is to elevate the stump and compress the main artery; if hemorrhage continues, open the wound, turn out the clots, wash with warm bichloride solution, search for and tie the bleeding vessels. If there be much oozing, elevate the part, and then apply broad compresses. Sponge with warm water; expose it to air for some time.

Secondary Hemorrhage comes on after twenty-four hours from the time of the operation, but more generally about the time of the separation of the ligature. The mode of procedure is to remove the dressings; if there be merely oozing, proceed as directed in Consecutive Hemorrhage, but if the dressings are saturated with blood, the parts swollen and painful, and there are other evidences of profuse loss of blood, re-open the wound, turn out the clots, search for the bleeding vessels and ligate them.

Secondary hemorrhage may take place at the time of the separation of the ligature, and it generally comes from the distal end of the artery. This should be frustrated by compression; but if the hemorrhage continues or recurs, it is proper to cut down upon the artery and ligate it.

Secondary hemorrhage may occur from *sloughing* or *ulceration* of an artery, or from imperfect closure of an artery when a ligature separates, either through a diseased state of the artery or of the constitution. In this case it is necessary to cut down upon and secure the bleeding orifice; if this cannot be done, carefully graduated pressure and styptics may be tried. A small button of lint, saturated with perchloride of iron, may be put into the bleeding point, over which large compresses are placed and firm pressure applied. The bleeding surface may be touched with a hot iron raised to a "black heat," which will sometimes be more efficacious than any other styptic. Should these measures fail, the artery must be tied above the point of hemorrhage, and, finally, amputation may be necessary.

When there is bleeding from arteries the following rules are to be observed:—

Should there be bleeding from an open wound, cut down, and tie the artery at the site of the wound, no matter what its condition; if the artery be brittle, resort to acupressure.

If an artery has been wounded, and there is no bleeding when the surgeon first sees the case, it should be let alone, because hemorrhage may not recur; but a provisional tourniquet should be placed over the situation of the main trunk, so that it may be tightened should the slightest appearance of blood make it necessary. The exceptions to this rule are when a patient is to be transported some distance, when the patient is a hard-drinking man, when the vessel lies directly in the wound, so that it can be seen; in these cases the wounded artery should be secured at once.

If the artery be partially or wholly divided, cast a ligature around each end.

In applying a ligature, if a branch is given off near the wounded artery, include it in the grasp of the ligature, or secure it separately.

If the branch of a main artery is wounded near the trunk, treat it as though it were a wound of the main trunk.

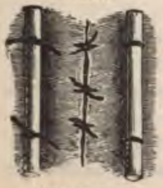
On cutting down on a divided artery, if the distal end be so far retracted that it cannot be found, tie the cardiac end, and place plugs of iodoform gauze in the wounded or distal side, keeping it in place by successive layers of gauze and a bandage from the distal extremity of the limb to the site of the wound.

SUTURES.

Sutures are made of catgut, silk, or wire.

The sutures ordinarily in use are: 1. The *Interrupted.* 2. The *Twisted.* 3. The *Glover's or Continuous* Suture. 4. The *Quill* Suture. 5. *Lembert's* Suture.

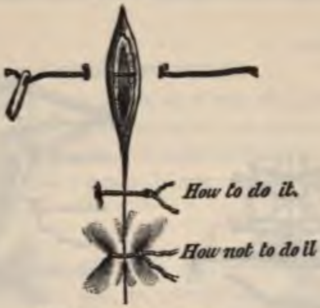
FIG. 4.



Quill Suture.

1. **The Interrupted Suture.**—The needle, carrying a single ligature, is passed through the skin on one side of the wound from *without inward*, and is then inserted from *within outward* at the corresponding point on the opposite side of the wound. The ends of the ligature are drawn together and tied tightly in a double knot. The ligature is then cut and another suture introduced at an interval of half an inch, and so on.

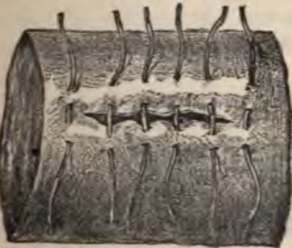
FIG. 5.



The Interrupted Suture.

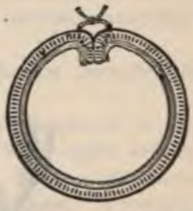
Lembert's Interrupted Suture is recommended in wounds of the intestines. The stitches should be three-eighths of an inch from the margin of the wound, the middle suture being first introduced; the distance between the sutures should not exceed a quarter of an inch. When the requisite number have been applied, the ends are to be tied, and cut off close to the knot. The bowel is then restored to the abdominal cavity and a glass drainage tube inserted.

FIG. 6.



Intestine united by Lembert's Suture. (*Walsham.*)

FIG. 7.

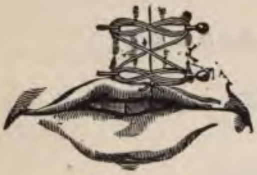


Section of Intestine united by Lembert's Suture. (*Walsham.*)

2. **The Twisted or Harelip Suture.**—Having placed the edges of the

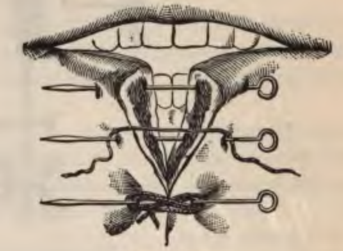
wound accurately in contact, a sufficient number of needles are passed through the edges of the wound. When the necessary number of needles have been introduced and the parts have been accurately adjusted, the middle of the long ligature is twisted around the uppermost needle in the form of a figure ∞. Then the two ends of the ligature are brought down and twisted around the other needles successively, when they are secured by a knot. After insertion the points of the needles must be cut off with pliers. The upper pin must be removed at the end of the second day, and the lower pin at the end of the third day.

FIG. 8.



Harelip Suture.

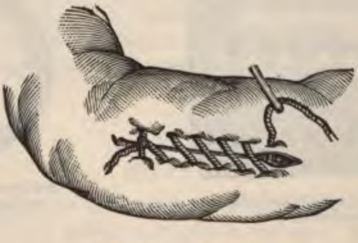
FIG. 9.



Harelip Suture.

3. **The Glover's or Continuous Suture.**—This suture is employed in wounds of the intestines and abdomen. It is applicable to cases of injury of great extent when there is tendency to the escape of fecal matter in the intervals between the stitches. It is merely the ordinary stitch employed for sewing materials together; it is made by simply passing the needles diagonally from one side of the wound to the other.

FIG. 10.



The Glover's Suture.

WOUNDS.

A Wound is a solution of continuity, or separation of continuous parts, suddenly occasioned by external violence, and generally attended with hemorrhage.

WOUNDS OF VEINS.

Hemorrhage from wounded veins is not, as a rule, dangerous, unless from a large and deep-seated trunk in which valves are not present, or from a large varicose vein of the leg. The bleeding in ordinary cases may be restrained by pressure and by a raised position; it may, in rare cases, be necessary to apply a ligature.

WOUNDS OF THE ARTERIES.

Arteries consist of three coats: first, the internal coat, which is a serous membrane, made up of an elastic longitudinal layer, interspersed with connective tissue corpuscles and lined by endothelial cells; secondly, the middle or muscular coat, made up of muscular and elastic fibres; and, thirdly, a fibrous coat, consisting of fibrous tissue.

The sheath of the artery is derived from the deep fascia of the parts surrounding it; on the sheath ramify nervous filaments and the vaso-vasorum.

The wounds of arteries may be incised, lacerated or punctured.

Lacerated arteries, when torn across, contract almost immediately, and bleed but little. The most approved method is to apply ligatures; otherwise, when reaction takes place and the power of circulation is restored, hemorrhage will ensue.

Punctured wounds are followed by a tumor, bearing the characters and requiring the treatment of aneurysm.

Contused wounds, such as are produced by severe bruises or by gunshot wounds, sometimes destroy the vitality of a portion of the artery, and are frequently followed by sloughing and fatal hemorrhage. In these cases the patient should be kept at rest until the sloughing process is completed. A precautionary tourniquet should be placed around the limb, and the patient instructed in its use in case hemorrhage should ensue.

If an artery of small size be cut across, there will be brisk hemorrhage for a time, but it will soon cease; the divided artery contracts and the vessel retracts within its sheath, and there is coagulation of the blood upon the face of the wound, sufficient to temporarily arrest the bleeding. Then the column of blood *inside* the vessel coagulates, and, lastly, there is exudation of the fibrin around and between the cut edges, which seals up the opening permanently by becoming organized.

The coagulum within gradually becomes firmer, adheres to the walls of the vessel, loses its color, and forms, with the impervious end of the artery, a fibrous cord.

If a *very large* artery is wounded and the aperture is large, and the flow of blood not opposed, the loss of blood will be so rapid as to occasion death at once; but if the wound be very small, it may be closed by coagulated blood during syncope, and the patient, if properly treated, may survive.

If the artery be of the second order, as the tibial, the bleeding will most probably cease when syncope supervenes; but when the faintness has passed off, the bleeding will recur, and the patient may die, unless the bleeding be checked by the surgeon.

A puncture or partial division of an artery is sometimes more troublesome than a complete division, because *contraction* and *retraction* are prevented. An oblique cut is likely to bleed obstinately; the aperture may, in favorable cases, be closed by adhesion, the artery remaining pervious; the uniting lymph, not infrequently, is dilated into a *false aneurysm.*

Treatment.—In the wounds of arteries the first indication is to stop the flow of blood. If the wound be small, and there is a bone underneath, the bleeding may be arrested by firm pressure of the finger; if the wound is wide and deep, the forefinger should be passed in, and pressure should be made with it on the exact spot from whence the blood issues, or the bleeding orifice should be seized with the finger and thumb; or the bleeding may be stopped by pressing the main artery above the point of injury; or a tourniquet may be applied; or, if no tourniquet be at hand, a handkerchief, with a stone placed in it, over the artery, may be tied around the limb, and twisted tight with a stick.

The immediate danger being averted, the surgeon next considers the best means of permanently arresting the hemorrhage.

The Ligature.—If the orifice of the artery projects, it should be taken hold of with the forceps and gently drawn out; then an assistant should tie a ligature properly around it. As a rule, the ligature should consist of small, round hempen thread, flossed silk, twisted silk, or catgut, tied so as not to divide the internal coat of the vessel, but simply to approximate it; if the artery is diseased and brittle, the ligature should be large and not tied too tightly.

If the bleeding orifice cannot be drawn out with the forceps, it may be transfixed with the tenaculum; in some cases it may be necessary to pass a curved needle and ligature through a considerable degree of the flesh, and tie all up together. After tying, the ends of the ligature should be cut off, but not too close to the knot. The ligature either becomes encysted or is absorbed.

In all cases *where it is possible*, a wounded artery must be tied at the wounded part. If this be not practicable, the next best plan will be to tie the *artery* ascertained to be the wounded one as near as possible to the bleeding point, and repeat this process at the distal side if bleeding occurs from that end.

Acupressure.—When it is not advisable to use the ligature, acupressure may be resorted to; the method of employing acupressure is, first, by passing a long needle through one of the flaps of the wound in such a way as to compress the bleeding artery; or, secondly, a small sewing needle may be employed, threaded with a short piece of inelastic iron wire, by which it may be pulled out. This is slipped down in the tissues on one side, then raised up and made to bridge over the vessel, while compressed with the point of the forefinger; this is circumclusion.

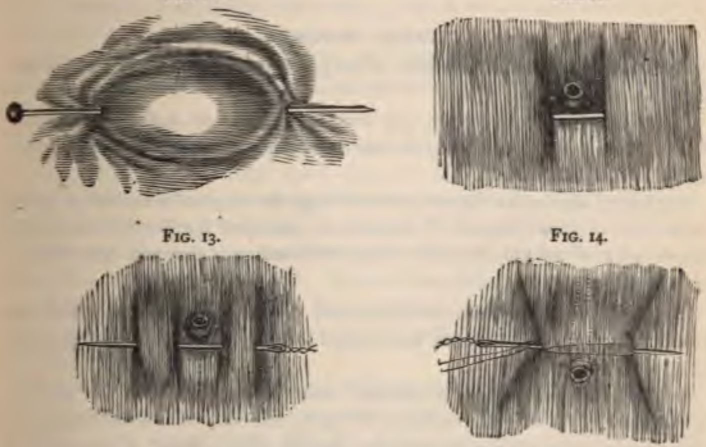


FIG. 11. FIG. 12.

FIG. 13. FIG. 14.

Different Methods of Acupressure.

In the third method the sewing needle is passed slowly behind the vessel, and a noose of fine iron wire passed over the point, brought over the vessel tightly enough to close it, and then secured with a slight twist round the eye end of the needle.

A fourth mode is to use a harelip pin, which is passed under the artery, and a piece of silk or lint passed or twisted around it, sufficiently tight to stop the flow of blood through the vessel.

Torsion.—This is performed by drawing out the vessel from its sheath, by a pair of *broad-pointed* spring forceps, and then twisting it around freely, as far as its natural connections will allow; or it may be performed by drawing out the vessel, fixing it by one pair of forceps a quarter or half an inch from the end, and then with another pair twisting the end around until it does not untwist itself.

Pressure is used when the wounded artery is situated immediately over a bone. If possible, the pressure should be confined to the bleeding orifice, and be effected by a *graduated compress.*

Cold is applicable to cases of bleeding from numerous small vessels. Hot water is a preferable agent as a hæmostatic.

Styptics are frequently used; tincture of perchloride of iron, saturated solution of alum, turpentine, creasote and nitrate of silver are the best. The actual cautery is most potent.

INCISED WOUNDS.

An **Incised wound** is a division of the parts, more or less extensive, according to the extent of the injury.

The fibres have only been simply divided; there is no contusion or laceration; hence they are not likely to take on severe inflammation, nor are they apt to slough or suppurate.

Upon the extent and color of the hemorrhage the surgeon is enabled to judge of the kind of vessel injured; if an artery is wounded, the blood flows rapidly in jets and is of a florid color; if a vein, the bleeding is slow and the blood is of a purple color.

Treatment.—In a recent incised wound the indications are to check the bleeding, remove all extraneous matter, and to bring the parts in perfect apposition.

To check the hemorrhage, steady and continued pressure upon the surface, with a sponge wet with hot corrosive sublimate solution, will be sufficient, as a general rule. Should the hemorrhage proceed from a vessel of some size, a ligature should be applied.

So soon as the bleeding ceases, all clots are to be completely sponged away and all foreign bodies must be carefully removed; the edges are then to be brought together in their entire extent, retained in contact by means of sutures. The wound being dressed, the parts must be placed at rest, in a relaxed position.

The wound must not be entirely closed, lest the secretions be retained; if this be allowed to take place erysipelas may follow, and there will be risk of septicæmia. Drainage must be provided for by means of drainage tubes; they should be placed in the wound before it is closed, care being taken not to let them remain in too long. When the bloody serum ceases to flow the tube must be removed, unless there is prolonged suppuration. The ligatures may be cut off short.

Dress the wound antiseptically. If the biceps be divided, the limb must be bent at right angles; if the triceps be injured, extension will be necessary.

LACERATED WOUNDS.

Lacerated wounds are those in which the fibres, instead of being divided by a cutting instrument, have been torn asunder by violence.

The edges of the wound are ragged and irregular; there is little pain or hemorrhage, and the surrounding parts, frequently bruised and discolored, are cold and numb.

A lacerated wound differs from an incised one, in the slightness of the pain and hemorrhage; in its tendency to suppurate and slough, and in its liability to be followed by erysipelas, septicæmia, pyæmia, tetanus and other nervous symptoms.

When the lesion is very extensive, the attendant shock being necessarily severe, local sensation is obliterated, but when reaction takes place the pain is frequently intense.

The treatment of lacerated wounds does not greatly differ from that of incised wounds. All foreign bodies must be removed, the vessels tied, the edges gently approximated. Guard against secondary hemorrhage by applying, if possible, a provisional tourniquet to the part, to be tightened on the slightest appearance of blood. Great care must be taken to select a sound portion of the artery when the ligature is applied. Venous hemorrhage may generally be controlled by a compress and roller. All tension is to be carefully avoided, and the edges are to be trimmed with scissors and the wound closed with sutures, using drainage tubes if necessary.

To moderate the inflammation bichloride irrigation is to be used, either warm or cold. Should suppuration present itself, spray the wound with peroxide of hydrogen, wash with corrosive sublimate solution and dress antiseptically, and when the granulating process is established, apply a solution of nitric acid three drops and water an ounce; opiate cerate or dilute ointment of nitrate of mercury may be employed. Should the inflammation run high and gangrene be threatened, purgatives should be used, and antiphlogistic regimen observed.

Anodynes, to allay pain and produce sleep, must be freely given. Secondary hemorrhage may arise as soon as reaction takes place, or it may occur when the sloughs begin to separate; this will likely take place in five or six days from the date of the injury and should be carefully guarded against, especially if a large artery is involved.

Should tetanus set in, it should be promptly treated with anodynes, using opium, hyoscine, bromide of sodium and chloral freely; blister the part, or paint it with tincture of iodine, or use cold bichloride irrigation.

CONTUSED WOUNDS—OPEN.

Contused wounds are usually produced by greater violence than the preceding, and are accompanied with greater disorganization; blood is extravasated, cellular tissue is broken down, muscles bruised, and the surrounding parts are apt to be disorganized.

They bleed but little, in consequence of the organization of the parts being destroyed. The pain which accompanies a wound of this kind is in inverse ratio to the amount of the injury. When there is a moderate contusion the pain is generally severe, and when there is a violent degree of contusion the patient scarcely suffers any pain until reaction sets in.

Treatment.—If there is hemorrhage, it is to be controlled in the usual manner, by compression, hot water and ligatures. When an artery lies exposed in contused wounds, ligatures should be applied both above and below the point of lesion. The edges of the wound must be brought together gently, allowance being made for swelling and drainage. If it be necessary to use sutures to bring the parts together, it is proper to do so.

Apply the usual antiseptic dressings. When the inflammation is very active leeches may be necessary.

Pain and nervous symptoms are controlled by anodynes and antispasmodics.

After the lapse of a few days, if the wound has healed, the part may be bathed with tincture of camphor, soap liniment, or dilute tincture of iodine.

CONTUSED WOUNDS—SUBCUTANEOUS.

Contusions producing subcutaneous injuries are caused by blows from a hard blunt object, or by violence applied to the injured part. The surface is not broken, but, as a rule, blood is extravasated under the skin. The injury is to the soft parts under the skin; the connective tissue with its delicate vessels primarily; then the muscles may be crushed or torn; next the lymphatics and arteries; the nerves show the most resistance, though they may be violently stretched.

Contusions vary in degree from a trivial bruise to absolute crushing of the part. In the slightest cases there is no perceptible bruise—merely redness and swelling, with local pain, which soon subsides; in those that are more severe there is ecchymosis, some of the capillaries being ruptured, blood effused into the skin or subcutaneous tissues, when swelling and discoloration make their appearance. In the worst cases the amount of extravasation may be enormous, as where a large vessel has been ruptured, or where the tissue is easily torn. The scrotum, or the loose cellular tissue of the female genitals, may be swollen to an enormous size. From hemorrhage alone, the case may prove fatal almost at once.

The changes that take place in the part depend upon the amount of extravasation, the tension, the nutrition of the surrounding tissues, and the treatment that the injured part has received. *Absorption* is the rule, but if the tension is great, as when a large artery is severed, or if the part is not kept at rest, or if the surrounding tissues are badly nourished, inflammation may ensue, when *suppuration* is very likely to follow.

The degree of swelling, of course, varies with the amount and situation of the extravasation, and the looseness of the tissues. As a rule, the pain depends upon the amount of tension. In some instances the shock is very severe, as when the testis is squeezed, or the abdomen struck. If a large vessel is torn, the loss of blood may at once prove fatal. When the bruise is superficial, the staining of the skin will soon show itself; when deep, it may not appear for weeks.

Traumatic fever is a usual accompaniment, and in cases of large extravasations may be very severe, lasting for several days.

Treatment.—Slight contusions are best treated with cold or evaporating lotions. Lead water and laudanum, or acetate of lead in a decoction of powdered opium are especially useful. Where the extravasation is considerable, uniform, gentle compression with many layers of cotton wool checks the increase, limits the hyperæmia, and promotes absorption. This treatment will be found efficacious even when bullæ are forming upon the skin. The fluid should be drawn off through a minute puncture, absorbed with cotton wool or thick blotting paper, the epidermis carefully replaced, a little iodoform dusted on, or collodion painted over, and then cotton wool carefully applied.

In very severe cases where there is risk of suppuration, the tension may be relieved by the aid of the aspirator. Only a small portion of the fluid need be removed—sufficient to relieve the tension; this will at once diminish the hyperæmia, when absorption will proceed unchecked.

The contusion is sometimes so severe as to kill the skin. If the injury be small, and the deep structures not badly implicated, the slough should be allowed to separate itself; but where the skin has been stripped off from the subcutaneous tissue to some distance above the apparent seat of injury, and it is thought advisable to amputate, the line of incision must be carried well above, or the flaps will be sure to slough.

PUNCTURED WOUNDS.

A punctured wound is one made with a narrow-pointed instrument, such as needles, nails, splinters, swords, bayonets, scissors, hooks, etc.

These wounds are much more dangerous than cuts or incised wounds, from the effects they produce on the injured part.

A slight punctured wound through the skin into the cellular tissue will sometimes be followed by red lines along the course of the absorbent vessels, from the wound to the absorbent glands.

If a tendinous structure be punctured, alarming symptoms will frequently follow.

In punctured wounds their depth is usually much greater than their width, making it frequently difficult to determine the amount of injury inflicted.

The pain is often very great, depending upon the injury sustained by the nerves. Punctured wounds are rarely attended with much hemorrhage, and sometimes with hardly any.

They are very liable to be followed by erysipelas, angeioleucitis, abscess, and wasting of the muscles.

The treatment consists in the extraction of foreign substances, if there be any, in checking hemorrhage, in moderating inflammation, and preventing the development of nervous symptoms.

All such articles as fish hooks and similar barbed substances must be extracted by counter-openings, or pushing them through the part in which they may be imbedded.

If bleeding arises by reason of an artery having been laid open, it must be exposed and tied at both ends. A full anodyne should be administered, and the parts dressed antiseptically. Great care must be exerted to see that full and sufficient drainage is established. It is always safe and frequently absolutely necessary to change a punctured wound into an incised wound by free incisions.

GUNSHOT WOUNDS.

Gunshot wounds are injuries caused by substances discharged from firearms, by fragments of stone or wood struck thereby, and by the bursting of firearms and shells.

The symptoms are local and general, and vary in character, according to the extent of the lesion, the importance of the tissues involved, and the idiosyncrasy of the individual.

The pain is often insignificant, and a person severely hurt may not be conscious of having received a wound until some time after it has been inflicted. The pain is of a dull and heavy character, unless a nerve is struck, when it will be sharp and severe, and burning or pricking.

Bullets penetrating the flesh usually produce a burning sensation more or less acute. When bones are broken stinging accompanies the burning. When bones are hit but not broken, there is a numbing sensation in the whole region involved in the shock, followed very soon by severe and sometimes intense pain.

When muscles and tendons are involved, there is a tugging sensation, sometimes very slight; shell wounds produce feelings similar to those by bullets, more or less exaggerated, according to the size of the missile and the degree of velocity.

A spent cannon shot, *i. e.*, a ball slowing up and rolling along the ground at the rate at which a man moves when walking, will crush the bones of the foot or leg that resists or opposes it. A cannon ball having sufficient velocity to keep in the air will make a clean cut of flesh, bones, and ligaments.

The suffering is generally great when a bone is broken, a large joint penetrated, or a visceral cavity opened.

Owing to the contused and lacerated nature of the lesion, hemorrhage in gunshot wounds is not in proportion to the severity of the injury, unless an artery be laid open; the hemorrhage is generally external, the blood issuing from both orifices of the wound.

In wounds of the chest, abdomen and pelvis, the hemorrhage is usually internal.

Gunshot wounds are exceedingly liable to secondary hemorrhage. When secondary hemorrhage sets in, as the result of sloughing, it usually arises between the tenth and fifteenth day.

The shock in these injuries is generally most intense when the ball traverses the head, chest, abdomen or pelvis.

Treatment.—The indications are to promote reaction, arrest hemorrhage, ascertain the condition of surrounding parts, extract all foreign bodies, remove loose pieces of bone, if any, and endeavor to control resulting inflammation.

A probe is used to examine the wound; either the long metal probe or the porcelain tipped instrument of Nélaton may be employed. A piece of soft pine wood or a clay pipe stem may be substituted for the ordinary probe. When examining wounds of the brain aluminium probes should be employed.

Reaction is brought about by employing the ordinary restoratives; the patient must be placed in the horizontal posture; cold water should be dashed in his face; he must be made to inhale ammonia water. If necessary, sinapisms must be employed, as well as stimulating injections used, and if he is able to swallow, brandy should be given him, or wine, or ammonia properly diluted.

If the hemorrhage be capillary, it will probably soon cease; if not, cold water, pounded ice, or some mild astringent lotion should be used; if, however, the hemorrhage proceed from an artery, the ligature must be promptly resorted to.

Before deciding upon the condition of the wound, care must be taken to ascertain if there be any foreign substance present, and if there be, to remove it, and also whether any neighboring bone be injured.

The next point is to hunt for, and, if possible, extract the ball. If more harm would result by attempting the removal of the ball, than by its remaining in the wounded part, it should not be disturbed.

To control resulting inflammation, great care must be taken to properly dress the wound by gently applying a roller, if necessary; put it on in such a manner as not to impede drainage.

The usual antiseptic dressings are to be employed.

DISSECTION WOUNDS.

Dissection wounds are those contracted in the examination of dead human bodies.

Symptoms.—The disease commences at the inoculated part, from whence it spreads.

The first symptom that attracts attention is a stinging or burning sensation; upon examining the part a little whitish vesicle is observed, extremely sensitive on pressure. When the vesicle breaks a small ulcer is exposed. The pain by this time is very great, the sore enlarges, the swelling increases, and the part feels hot, tense and numb. A red line is usually seen extending from the point of inoculation, along the arm to the axilla. As the disease spreads the whole limb becomes enormously enlarged, pitting on pressure, and looking dusky and erysipelatous.

Cases occur where the symptoms begin at the axilla and extend from thence up the neck and down the side.

In the worst forms the disease soon reaches a crisis; the system rapidly falling into a typhoid state.

Treatment.—As soon as a wound of this kind is received it should be thoroughly washed with warm water and soap; this should be followed by suction by the mouth. If the wound is small it should be dilated; if it has bled, thoroughly cauterize with acid nitrate of mercury, or nitrate of silver, hydrochloric, nitric or sulphuric acid.

If a vesicle forms it should be freely opened, and then thoroughly cauterized; antiseptic dressings should be applied, and, if necessary, a purgative administered. To relieve the excessive pain and restlessness anodynes should be freely employed, and if the skin be hot and dry aconite or veratrum viride should be administered.

To meet the typhoid symptoms, milk punch, quinine, iron and other such treatment should be resorted to as will support and sustain the patient.

WOUNDS OF THE THROAT.

The usual causes of these injuries are attempts to commit suicide; the parts injured are the pharynx, larynx, trachea or œsophagus.

In these cases the carotid is rarely reached, owing to the incision being made high up, and to the head being thrown backward.

The larynx is most frequently injured; it is characterized by air and blood issuing from the wound with great rapidity, especially when the patient coughs. The arteries that are usually wounded are the sublinguals. Should the external carotid be divided, death would ensue before assistance could be rendered.

When the injury is above the larynx, the lips of the wound must be carefully brought into apposition and kept in place by sutures. The head must be brought down upon the chest, and confined in that position, in order to prevent a separation of the edges of the wound. If there be a tendency to œdema of the larynx, intubation, or tracheotomy must be performed.

The mouth must be kept cool and moist; and for this purpose a slice of lemon dipped in water, or a wet rag, or pieces of ice, may be inserted from time to time.

The patient should be carefully nourished, by nutrient enemata, with opium added, if necessary, and when food is given by the mouth, it is best to commence with semi-solids, such as jelly, etc. If he is unable to swallow he may be fed by means of a stomach tube.

If the wound is in the thyroid or cricoid cartilages, the air rushes through the aperture in expiration, and violent coughing is produced. The treatment is the same as in the preceding case.

When the injury is inflicted within three inches of the sternum, it is more dangerous than in any other situation; here the trachea is in the forepart, the œsophagus behind, and the carotid arteries are close to the trachea.

The first object is to stop the bleeding; and if the opening is not sufficiently large, an incision should be made in a longitudinal direction, to expose the mouth of the vessel, in order to secure it with the least possible delay. The wound is not to be entirely closed, otherwise emphysema may ensue.

GUNSHOT WOUNDS OF THE CHEST.

These may be divided into the *non-penetrating* and *the penetrating*. The non-penetrating are those affecting the soft parts and the ribs; the penetrating are those in which the lung is directly injured. The missile may pass through entirely or partially, and lodge in the pleural cavity, or it may pass directly through the chest and lung.

Symptoms.—More or less collapse, depending on the time that has elapsed since the wound. Face anxious, breathing labored, respirations frequent. Blood expectorated in more or less large quantities; air generally found passing from surface of wound, and usually there is emphysema in the neighborhood.

Treatment.—Patient must be placed in bed and careful search made for the ball; when there is no counter-opening, the ball may be often found on the opposite side. Splintered fragments of ribs should be removed and any sharp ends of bone rounded off. If the collapse is not severe the patient should not be disturbed, so that an opportunity may be given for clots to form and bleeding to cease.

A light antiseptic dressing should be placed over the wound and the patient carefully watched.

WOUNDS OF THE JOINTS.

A wound may usually be known to have penetrated the joint by the escape of synovia, though this is not invariably the case.

Treatment.—The parts must be shaved, carefully cleansed, and dressed antiseptically, due regard being had to free drainage.

The limb must be absolutely immovable, and for this purpose a proper splint must be applied. The Plaster-of-Paris splint is usually employed.

QUESTION OF AMPUTATION IN WOUNDS.

Amputation should never be performed until reaction has set in.

It should be resorted to when the limb has been run over by a heavy vehicle, crushing the bone and tearing open the soft parts; when, in addition to serious injury inflicted upon the integuments, muscles or bones, the principal artery, vein, or nerve has been lacerated; when a large joint is penetrated, accompanied by comminuted fracture. If mortification sets in, amputate high up. If it is an injury of the leg, and the bones are shattered, and the posterior soft parts are not lacerated, and the main artery is intact, an effort should be made to save the limb.

HYDROPHOBIA.

This disease is the result of poison, caused by inoculation with the saliva of rabid animals.

Symptoms.—The first symptom a person experiences who has been bitten by a rabid animal is pain in the injured part, and this may be felt between the second week and ninth month after a bite (sometimes a much longer period will elapse). The next symptoms are low spirits, a sense of chilliness, succeeded by rigors and heat, headache, stiffness of the neck, soreness of the throat; then a difficulty of swallowing is felt, not of liquids in particular, but of any substance; so that the patient avoids making an effort; but upon applying a cup to his lips, he will be seized with the most painful shuddering; he will turn away to avoid the sight of what he was about to take, and sit down in a state of exhaustion.

From this time the most prominent symptoms will be difficulty of breathing and swallowing, extreme irritability of the body and disorder of the mind.

Treatment.—Immediately after the individual has been bitten, place a tight ligature above the affected part, and, if possible, at once have the wound vigorously sucked, and then, as soon as may be, cut it out and thoroughly cauterize the whole. Mr. Youatt prefers nitrate of silver, but many authorities place a small piece of potassa fusa into the wound, allow it to dissolve, when its cauterizing influence will be communicated to all parts of the wound.

It does not appear that there is any cure for this affection. The general treatment should be that indicated under the head of tetanus.

M. PASTEUR'S METHOD OF TREATMENT OF PERSONS BITTEN BY RABID ANIMALS.

As M. Pasteur's method of treating persons who have been bitten by rabid animals has attracted considerable attention, the following synopsis of his mode of conducting a case of the kind is here engrossed:—

The substance used for inoculation is perfectly pure veal broth, exempt from any microbe, in which has been dissolved a little of the spinal marrow of a rabid rabbit. The broth, carefully prepared, is put in a glass receiver of spherical form, with long neck hermetically sealed. It is then submitted for half an hour, under pressure, to a heat of 239° F. This boiling is for the purpose of destroying all germs. When perfectly clear, it is decanted in one of Pasteur's receptacles. To obtain the infected marrow, a rabbit having been chloroformed and trepanned, the infected broth is injected under the dura mater, when the edges of the wound are stitched together, and the rabbit is left to recover.

After inoculation, rabies declares itself in the rabbit at the end of six days. Two or three days later the animal dies. The spinal column is carefully extracted, and then hung up in a flask containing caustic potash. It is placed in a room kept at a heat of 68° F. When the infected substance is to be used, a piece about a centimetre in length is cut off and mixed with pure broth. The first day the patient receives half a hypodermic syringeful of broth, with marrow of thirteen days' strength. The following day the patient receives a hypodermic of twelve days' strength. Each day the marrow is one day younger. The operation is repeated daily for twelve days.

BURNS AND SCALDS.

Burns and scalds are divided according to their severity; those which produce more redness, followed by desquamation of the cuticle, and those attended with destruction of tissue.

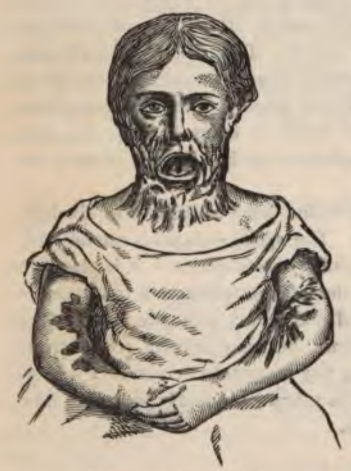
Symptoms.—The severity of the constitutional effect of burns depends on their extent rather than their depth; it is likewise modified by their situation and by the age of the patient.

An extensive burn is more serious in its immediate results than a smaller though deeper burn. Burns of the chest, abdomen, head and face, are followed by much more severe symptoms than more extensive burns of the extremities.

The earliest symptoms are those of shock; the skin is cold, accompanied by shivering; the pulse is rapid and feeble, sometimes thready; the pain is severe, and of greater intensity in slight than in deep burns; in the worst cases it is nearly or quite absent. In children, vomiting is an early symptom. When the mouth and pharynx have been scorched there is thirst and dysphagia; the urine is scanty, frequently albuminous and bloody. The patient may lapse into a drowsy condition, followed by coma and death; or there may be restlessness, delirium and clonic spasms.

If life be prolonged, reaction sets in after twenty-four or forty-eight hours, and the general febrile symptoms of traumatic fever present themselves; these symptoms are kept up by the absorption of inflammatory products, and if decomposition takes place there will be septic poisoning. Constipation is followed by diarrhœa, which is often profuse and exhausting.

FIG. 15.



Distortion from Burns.

A singular accompaniment of severe burns is a liability to be followed by acute ulceration of the duodenum (Curling's ulcer); this may terminate fatally by perforating the intestine and causing peritonitis.

Pulmonary complications frequently occur.

The process of separation of the sloughs is usually completed by the end of the second week, when. the stage of suppuration begins. Weakness is often extreme, hectic may result, and death ensue from exhaustion.

As consequences of burns and scalds, vicious scars are formed, and contiguous surfaces are apt to adhere together, with retraction of the affected part, producing ankylosis of the neighboring joints and terrible distortion.

Treatment—Constitutional.—A stimulating plan of treatment is almost invariably necessary, and depletion is rarely advisable even in the presence of inflammation of internal organs. In the first stage the aim is to establish reaction and relieve pain.

To raise the system from the depression into which it frequently sinks, anodynes should be resorted to early, and given in large quantities. The strength must be maintained by nutritious diet, together with stimulants; quinine, ammonia and hot brandy and water should be freely resorted to. Sinapisms should be applied along the spine. Diarrhœa must be arrested by astringents and opiates.

Local Treatment.—In the local treatment of burns, the protection from and exclusion of air from the burnt surface, and the prevention of decomposition are the indications. The body should be exposed as little as possible. The use of antiseptic dressings, which seldom need renewal, will avoid the necessity of frequent change, and this is very desirable.

The severe pain is promptly relieved by the use of bicarbonate of soda, either applied in the form of paste made with water, or freely sprinkled over the raw surface.

Cold applications are useful in many cases, especially in summer; or the parts may be covered with a liniment of equal parts of linseed oil and lime water; or a lead lotion may be applied, or a weak carbolic solution.

Lint soaked in Goulard water is a remedy in frequent use.

Iodoform, which acts as a local anæsthetic, may be sprinkled over the surface if signs of decomposition appear.

S. D. Gross recommends an application of a weak solution of nitrate of silver to allay the scalding and smarting sensation. Mucilage of gum acacia, or mucilage of gum acacia mixed with linseed oil and lime water, has been found useful. The best dressing is a thick layer of bichloride gauze, heavily spread with vaseline, dusted with iodoform.

Ulcers resulting from deep burns are extremely intractable; they secrete pus profusely, and often many months elapse before they are healed.

In such cases, mild stimulants and astringents are advisable; especially carbolate of zinc lotion and bismuth ointment. When the discharge is very profuse, the sore should be kept constantly covered with finely-powdered chalk, or subiodide of bismuth. Skin grafting is frequently resorted to, with successful results. See page 39.

CHILBLAIN—FROSTBITE.

Severe cold causes an erythematous inflammation of the skin, described as frostbite, the effects of which are designated as chilblain.

The portions of the body that usually suffer are the fingers, tips and lobes of the ear, end of the nose, and the toes.

When the air is loaded with moisture, chilblain is much more apt to be produced than when the atmosphere is dry.

When a person has been exposed to very severe cold, and especially if he has been exhausted by fatigue, hunger, and watching, he feels an irresistible impulse to sleep, which, if yielded to, will soon end in coma and death.

The best remedy for a frostbite is to rub the part well with snow; if snow be not attainable, cold water must be substituted. These applications to be made in a room without fire, and a high temperature must be avoided for some time.

If the cold has induced coma, the best remedy is friction with flannel all over the surface of the body.

Warm drinks must be administered, such as coffee, tea, weak wine and water, to which a few drops of aqua ammonia may be added; if the patient cannot swallow, an injection of milk with a little brandy may be resorted to. When reaction is restored, the temperature of the room may be gradually raised.

Stimulating applications are to be used to relieve the itching and burning that accompanies chilblain; of these, tincture of iodine painted over the part; Wardrop's liniment, consisting of tinct. cantharides, ʒ iij; linimentum saponis, ʒ ix; turpentine, dilute, and carbolic acid, are most highly recommended.

Cod-liver oil, quinine, and tonic treatment generally are necessary.

See Formula 15, at the end of this book.

ERYSIPELAS.

Erysipelas is a diffused inflammation affecting the skin and areolar tissue; due to the streptococcus of erysipelas.

Symptoms.—Cutaneous erysipelas is known by redness of the skin, which disappears momentarily on pressure; the swelling is puffy, with a distinct edge; the pain is smarting, burning, and stinging. The redness is of a vivid scarlet hue, with a tendency to become yellowish if there be much debility. The nearest lymphatic glands are always swollen and tender.

In the *phlegmonous* erysipelas the redness is deeper; sometimes dusky and purple; the swelling is greater, and is hard and tense; or it may be more doughy and pitting on pressure; the pain is not only burning, but throbbing.

The disease begins with shivering, headache, pain in the back, nausea, vomiting, followed by fever, which is of a low type, especially if the patient be old and weak, or if it be of a hospital origin. Diarrhœa and perspiration may be present from the outset, particularly if the case be asthenic in character.

The *cutaneous variety* may terminate in resolution, with desquamation and slight œdema, or may subside, leaving *bullæ* or vesicles remaining under the cuticle, which dry into scales and peel off, leaving a healthy cutis and sometimes superficial ulcerations.

It may terminate by the appearance of small abscesses.

Ordinary duration is from seven to fourteen days.

The phlegmonous erysipelas often leads to diffuse suppuration of the areolar tissue, when the swelling is flaccid and *quaggy;* patches of the skin become purple and slough; the intermuscular tissue and fasciæ may suffer in the same way, and even if the patient escape with his life, the limb may remain permanently useless.

Phlegmonous erysipelas is more dangerous than the cutaneous variety; the disease is particularly to be dreaded when it attacks the scalp. In old persons, the intemperate, and in the very young, the prognosis is very grave. An epidemic of this disease is always more destructive to life than when it occurs sporadically. Traumatic erysipelas is always a cause for grave concern.

The tendency to relapse after the disease has disappeared from the part originally affected is very remarkable.

Treatment.—It is well to begin the treatment with a mild purgative, unless the patient be very weak and delicate; calomel, rhubarb, and compound extract of colocynth are the articles to be mainly relied upon. When the bowels have been thoroughly evacuated, none but the most gentle aperients should be employed, as blue mass, Seidlitz powders, etc. If there is irritation of the stomach, or diarrhœa, small doses of hydrarg. c. creta, with bismuth, may be used with advantage. If the cutaneous functions are more or less interrupted, diaphoretics are indicated; Dover's powder, with tepid sponging or warm bath, may be used. Anodynes, to allay pain and induce sleep, must be employed. When there is a tendency to prostration, stimulants and tonics must be early resorted to. The tincture of the chloride of iron, alone or with quinine, should be freely given.

Recently nitrate of pilocarpine in one-sixth grain doses, repeated at the end of two hours if no perspiration ensues, has been used at the Pennsylvania Hospital with highly satisfactory results. The remedy is not to be prescribed in cases where the heart is feeble and weak. In the exhibition of this drug especial care is to be exercised when prescribing it to negroes, as it is apt to produce on them exhaustive sweating.

Local Treatment.—The patient must be isolated, with an especial nurse in attendance. The inflamed part should always be kept warm and raised, air being excluded from the surface. Warm fomentations are the best, especially when medicated with poppy, hop, or chamomile. Cold applications are injurious. Tincture of iodine, sulphate of iron, a drachm to water a pint, tincture of the perchloride of iron, muriated tincture of iron, a solution of the acetate of lead and opium, chloride of ammonium, alcohol, chloride of sodium, carbonate of potassium and quinine; a subcutaneous injection of a solution of carbolic acid; nitrate of silver in solution, say from twenty to thirty grains to the ounce of water, applied directly over the affected parts, are all, in turn, highly recommended.

In the more simple varieties of the disease, it is sometimes useful to grease the part with vaseline, afterward covering it with a rag wetted with opiated water or to dust with starch, flour, arrowroot, prepared chalk, or carbonate of zinc.

In the *cellulo-cutaneous* forms of the disease, as soon as tension of the integument appears, incisions must be made deep enough to allow of the escape of the serum from the cellular tissue beneath and to relieve the tension. Some surgeons recommend that the incisions be free, so as to extend the whole length of the affected parts; others prefer a greater number of limited incisions; preference is given to the latter method. The long incisions are attended with copious hemorrhage and great risk of life, while the hemorrhage from the limited incisions can generally be controlled by elevation of the part and pressure, applying the usual antiseptic dressings.

SHOCK, OR COLLAPSE.

Shock, Prostration, or **Collapse,** are terms used to signify the loss of power which immediately follows severe injuries, especially those attended with violence. It is due to reflex paralysis of the vasomotor system of nerves.

Shock may be caused by any severe injury, especially gunshot wounds, compound fractures, severe burns, protracted surgical operations, and all cases in which serious injury is attended with violence, pain, and loss of blood. Mental shocks may be as severe and fatal as those of the body. Sometimes shock is so severe that the patient sinks from it without reaction; this is especially likely in injuries of the vital organs or of the abdominal viscera.

Treatment.—The patient must be kept in a horizontal position; all constricting clothing must be removed; free access to the cold air must be provided; cold water should be dashed into his face; a bottle containing dilute aqua ammonia should be held under the nostrils. If the case is unusually severe, atropia, or tincture of digitalis, or whisky, should be injected under the skin; stimulating injections should be thrown into the rectum. Hot brandy and water, if the patient can swallow it, is probably more efficient than anything else; a few drops of aqua ammonia may be added. An enema of hot water, to which has been added from two to four teaspoons of turpentine to a quart of water, is frequently of great service. A hypodermic injection of morphia, gr. ¼, is highly recommended to promote respiration. In severe and protracted cases certain symptoms present themselves that demand attention: *vomiting;* the remedies for which are iced soda water, with or without brandy; powdered ice introduced into the mouth and allowed to melt; effervescing draughts; sinapism to the epigastrium; creasote in small doses. *Hiccough* is relieved by the same remedies. Hoffman's anodyne, or chloroform, a few drops on ice, will often prove serviceable. Bleeding, if any exist, must, of course, be checked.

TETANUS.

Tetanus is a more or less violent and extensive contraction of the muscles of voluntary motion, attended with rigidity and tension of the parts affected; due to the bacillus of tetanus.

It begins, generally, with the muscles of the jaw. When it is confined to this part of the body, it is called *trismus*, or *locked jaw*. When all the body is affected, and becomes rigid, but retains its ordinary straightness, the case is one of *tetanus;* when the head is stretched backward, it is called *opisthotonos;* when the body is bent forward, it is called *emprosthotonos;* when the tension is confined to the muscles of one side, it is denominated *pleurosthotonos.*

Tetanus is again divided into *idiopathic* and *traumatic.*

Traumatic tetanus derives its origin from the infliction of wounds, and it arises more particularly from wounds of the extremities; it is produced, most commonly, in consequence of contused, lacerated, or punctured wounds. It will occur in all stages of a wound; it usually comes on some days after the occurrence of the injury.

Symptoms.—The patient finds a stiffness in the movement of the jaw; he experiences an uneasiness in swallowing, and he soon perceives that he has a difficulty in separating his teeth for the admission of food. He begins, now, to feel a pain behind the sternum, and this pain extends from the pit of the stomach toward the vertebral column. The muscles of the back, and of the neck and back, begin to be affected by spasms, then those of the abdomen, afterward those of the limbs, and lastly those of the face.

The muscles become more and more rigid as the case proceeds. In the extreme period of the disorder all the muscles of voluntary motion are affected;

among others those of the face; the forehead and nose are drawn up; the eyes are distorted, fixed, and motionless; cheeks retracted, and the features undergo an extraordinary change. The spasms become universal, and a violent convulsion puts an end to the misery of the patient.

Idiopathic tetanus arises more frequently in hot than temperate climates.

Prognosis.—In the acute form very grave; in the chronic form favorable.

Treatment.—The indications are to husband the strength of the patient till the disease shall cease; to remove, as far as practicable, all conditions believed to have the power of creating the tetanic state, and to employ any sedative or special treatment from which we may hope to derive advantage.

The chief thing to be attended to is perfect quiet; the room should be kept dark, and the patient kept, as nearly as may be, in perfect repose; remedies should be administered as gently as possible; everything harsh or violent should be avoided. If nourishment cannot be swallowed, it should be administered *per anum;* it should be as plentiful as the nature of the case will admit; the supply of brandy and wine should be abundant. Quinine and iron should be freely administered; opium and morphia have, in many cases, been serviceable; chloral hydrate, chloroform, Indian hemp, and tobacco have all been tried, in turn, and sometimes with success. Hydrobromate of hyoscine has recently been highly recommended in the treatment of convulsions.

Surgeons place their main dependence upon large doses of bromide of potash and chloral. Should suffocation be threatened from spasm of the glottis, inhalations of nitrite of amyl should be resorted to: the usual quantity administered is from five to ten minims.

INJURIES OF THE HEAD.

Wounds of the Scalp.—These must not be neglected, however slight; they may be followed by erysipelas, inflammation, and suppuration. All wounds should be quickly closed; the scalp should be shaved for some distance around the wound; care should be taken to wash away all foreign bodies and *clots* with bichloride of mercury solution and a syringe. No part of the scalp, however torn, should be cut away. Careful coaptation must be made by means of sutures. If the injury be extensive and has possibly become infected, the safest plan is to resort to drainage. The patient should be confined to bed, or to the house, purged, and put on a milk diet.

Hemorrhage from small vessels is usually controlled by closing the wound and using pressure; larger vessels must be secured.

Every scalp wound should be carefully examined with the finger and probe, so as to ascertain whether or not fracture of the skull exist.

If *suppuration* occur, indicated by rigors, chills, dry tongue, with increase of swelling and throbbing pain, the adhesions must be separated at any suspicious spot and free drainage established.

If there be *suppuration under the scalp*, counter openings should be freely made, drainage established, and then dressed antiseptically.

If there be *serous effusion*, it may be necessary to let it out by one or two punctures.

TOPOGRAPHY OF THE BRAIN.

Rules for the location of various points.*

The Glabella is the small space between the eyebrows, and immediately above the line from one to the other.

The Inion is the external occipital protuberance.

The Median Fissure is represented by a line drawn from the glabella to the inion.

The Fissure of Bichat is between the cerebrum and the cerebellum; its position is ascertained by a line drawn from the inion to the external auditory meatus.

The Fissure of Rolando commences at half an inch behind the mid-point between the glabella and the inion; it is three and three-eighths inches long and forms an angle with the median line of 67°.

Horsley's Cystometer is used to determine the fissure of Rolando. It consists of an instrument made of metal or two strips of parchment paper, the antero-posterior arm being 14 inches long and the lateral arm being placed at an angle of 67°. The scale starts from zero, half an inch in front of the lateral arm, and runs forward and backward. To determine the fissure of Rolando, place the antero-posterior arm in the middle line in such a position that the glabella and the inion will each mark the same distance from the zero point to the scale. The lateral arm will then correspond to the fissure of Rolando.

The Fissure of Sylvius is determined by a line drawn from the external angular process to the occipital protuberance; on this line take a point one and one-eighth inches posterior to the external angular process; a line drawn from this point to the parietal eminence will represent the posterior branch of the fissure. The anterior limb corresponds to the squamoso-sphenoidal suture.

Rheid's base line is from the lower border of the orbit through the centre point of the bony meatus of the ear.

To Locate the Middle Meningeal Artery and its anterior branch, trephine one inch and a quarter back of the external angular process, on a level with the upper border of the orbit. The posterior branch will be found by trephining on a level with the same opening just below the parietal boss.

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* Condensed from "American Text-Book of Surgery."

To Tap the Lateral Ventricle, a trephine opening should be made one and a quarter inches behind the external auditory meatus and the same distance above Rheid's base line; a grooved director, or a small French catheter (No. 5), should be thrust carefully into the brain in a vertical direction to a point two and a half inches above the opposite meatus; if the ventricles are not distended, they will be reached at a depth of two and a quarter inches, but if dilated they will be found at a less depth.

In order to reach the Antrum, in a case of Abscess of the Middle Ear, an opening should be made from one-third to one-half an inch behind and above the centre of the meatus.

The upper third of the convolution which is situated in front of and behind the fissure of Rolando corresponds with the centre for movement in the leg; the middle third of the convolution is the centre for the movement for the arm; this third is subdivided into three parts: the upper part is for the centre for movement of the shoulder; the middle controls the movement of the elbow, and the lower portion that of the hand. In the last third of the convolution is situated the face centre. Vision is chiefly located in the cuneus.

Pressure on the Broca convolution will produce motor aphasia; on the lower portion of the Rolandic motor region it will cause paralysis of the opposite side of the face; as it extends upward in the motor region paralysis of the arm will ensue, followed by paralysis of the leg. The frontal and occipital lobes of the brain being latent areas, no localizing symptoms will follow from pressure, unless the cuneus should be involved, when hemianopsia of the same half of each retina will follow. Pressure on the angular or supra-marginal gyrus is apt to produce monocular Argyll-Robertson's pupil.

CONCUSSION OF THE BRAIN.

Concussion is a sudden interruption of the functions of the brain, caused by a blow or other mechanical injury of the head. Many surgeons consider this condition synonymous with laceration of the substance of the brain.

Symptoms.—In ordinary cases the patient lies for a time motionless, unconscious, and partially insensible; the pupils are more or less contracted and the patient turns away irritably from the light; if roused and questioned, he answers hastily and again relapses into apparent insensibility; after a time he moves his limbs as if in an uneasy sleep, vomits, and frequently recovers immediately afterward; remaining, however, giddy and confused for some hours after.

In the more severe cases the patient is profoundly insensible, the surface and extremities are pale and cold, and the features ghastly; the pupils are sluggish and sometimes dilated, but equal on both sides, unless the brain is injured; the pulse is quick, feeble, and intermittent, or hardly to be felt, and the breathing slow, or performed only by a feeble sigh drawn at intervals.

Vomiting is an important symptom. Its presence is generally an indication of approaching reaction and recovery. As reaction goes on, the pulse at first quickens, becomes stronger and slower, the carotids throb perceptibly; there are black spots and flashes of light in the eyes and noises in the ears; pain in the head is felt and increases; the eyes are suffused and the face flushed.

If the concussion be very severe it may be followed by immediate death.

Concussion is occasionally succeeded by a peculiar state of insensibility which may last some days. The patient lies as if in a tranquil sleep; his pulse is regular, but on the slightest exertion it rises to 130 or 140; when roused he answers questions, but immediately relapses into unconsciousness.

Treatment.—To recover the patient from insensibility and collapse, apply friction to the surface with the hand and warm applications to the feet; mustard plasters to the calves of the legs.

Stimulants, if used, must be employed with the greatest caution, so that reaction may not be too violent.

After reaction has taken place, the bowels should be acted on; quiet in a dark room, with rest and low diet, should be observed.

If the pulse becomes hard and frequent, and if the patient complains of pain, throbbing, or tightness in the head, or if he becomes flushed or delirious, or stupid and comatose, or if vomiting returns, blood should be taken from the arm, or by leeches from the head, and purgatives should be administered. Twenty grains of bromide of sodium should be given every four hours. The head should be kept cool. The patient should observe a cautious diet and remain free from excitement or fatigue for some time after the occurrence of the injury.

The consequences of concussion are persistent headache, deafness, giddiness, squinting, loss of memory, tinnitus aurium, etc.; for these a mild course of mercury may be necessary with iodide of potassium, together with repeated blisters, change of air, etc.

COMPRESSION OF THE BRAIN.

Compression may be produced by extravasation of blood, effusion of serum, fracture of the skull with depression, suppuration within its cavity, and by pressure produced by tumors or foreign bodies.

The symptoms are those of apoplexy. Insensibility, palsy, dilated and insensible pupil; slow, laboring pulse; skin often hot and perspiring; retention of the urine, through palsy of the bladder; involuntary discharge of fæces, through palsy of the *sphincter ani;* stertorous breathing, owing to palsy of the *velum pendulum palati; whiffing* or *puffing* respiration, from palsy of the buccinator and other facial muscles. The palsy, if it exists, will vary greatly in degree; if it be on one side, it will be opposite to the injury of the head. There may be convulsions, muscular twitchings, or rigidity.

The symptoms of compression by extravasation generally show themselves by the patient becoming stunned and insensible, from the concussion, with feeble pulse and cold skin. After awhile he recovers his senses, more or less perfectly, but again, in an hour or two, becomes sleepy, confused, and insensible, with slow, stertorous breathing, slow pulse, and dilated pupils.

Diagnosis.—In concussion, the symptoms follow the accident immediately; those of compression from effusion of blood *may* come on after an interval. In concussion, the pulse is feeble, irregular, or intermittent, the skin pale, and the respiration sighing and weak; in compression, when reaction is thoroughly established, the pulse will be slow and full, and the skin hot and perspiring.

In concussion, stertorous breathing and palsy are rare; in compression they are common.

In concussion the pupil is variable; sometimes contracted and sometimes dilated; in compression it is almost always dilated and insensible; frequently unequal on the two sides.

A differential diagnosis is very difficult between coma, the result of an injury, and that produced by opium, alcoholic intoxication, apoplexy, or uremia.

In opium poisoning there is a fixed, contracted condition of the pupil, slow, shallow respiration, and no paralysis. *In alcoholic coma* there is the general appearance of the individual; the pupil contracted to a pin's point, which slowly dilates when there is an attempt made to arouse him; the odor of the breath; and as a rule the ability to arouse the patient by hitting smart blows upon the soles of the feet. If there is doubt, the urine should be drawn and examined for alcohol. *In apoplexy* there is stertor, accompanied by a peculiar puffing in and out of the cheeks; the pulse is full and strong; the pupils fixed and dilated; or one may be dilated and the other contracted. *In uremia* the coma is not continuous; the breathing is quiet, not stertorous; there is no paralysis. There is usually œdema of the legs. The urine should be examined for albumin.

The treatment depends upon the cause of injury. Shave the head and examine carefully. If the compression be produced by fracture of the skull, treat it as directed under the subject of fracture of the skull, page 86; if the symptoms indicate that there is hemorrhage present, trephine, remove the clot and secure the bleeding vessel; if the pressure be due to pus, the abscess should be evacuated and drained; if there should be a foreign body or tumor present, it should be removed if it be a proper case for an operation; if there be effusion into the lateral ventricles, they should be tapped and drained.

FRACTURES OF THE SKULL.

These are caused by great violence, such as blows or falls on the head and gunshot wounds.

The ordinary type of **symptoms** and consequences of fractures of the skull depend on the conditions which accompany them, especially the amount of concussion; the forcing in of portions of the bone; the complication with scalp wounds; the situation and the inflammation excited.

Simple fracture with depression may be ascertained by examination of the shaved scalp; there will be a depression at one part, with a corresponding edge or projecting ridge around it.

Treatment.—In a case of simple depressed fracture, if there be no symptom of compression, and if the patient is conscious and rational, he should be kept on the strictest regimen; lying down, head raised, cold water to head, and aperients are the remedies.

Trephining is recommended in all cases of fracture with depression, whether symptoms call for it or not; under the belief that such sequelæ as epilepsy, fatuity, and softening of the brain may thus be avoided.

If **comminuted**, and it is probable splinters are sticking into the brain or its membranes, the bone must be elevated. If possible, it should be with the elevator alone.

Fracture of the Inner Table.—The inner table may be extensively splintered by injuries which perforate or slice through the outer table; such as cuts from sabres and blows with heavy weights. If, after careful examination, it is found that depression exists, the trephine should be used to raise or remove splinters.

Fractures of the base of the skull may run in various directions; they are most frequently found passing through the petrous, squamous, and sphenoid bones.

The **diagnosis** will be founded on the nature of the injury; the patient will probably be injured from having been pitched on his head; there will probably be bleeding from one ear; after the bleeding has ceased a most significant symptom is the draining through the ear of a clear fluid; symptoms indicating damage to the nerves that escape from the base of the skull may be noticed; bleeding from the nose and mouth will show the direction of the fracture; as a rule, if the fracture is of the anterior fossa the hemorrhage will be from the nose; if of the middle fossa, it will be from the ear; if of the posterior fossa, it may find its way into the pharynx, from thence into the stomach, and ultimately be vomited up. Hence care must be taken not to be misled and suppose that the stomach is involved in the injury.

Symptoms and prognosis depend on the amount of injury to the brain; stupor, dilated and unequal pupils, with rapid pulse, hot skin and dry tongue, and delirium are unfavorable symptoms.

Treatment.—Absolute repose, low diet, giving the patient a purge, ice or cold water to the head, and the bromides are the remedies.

If the fracture involves the middle ear, the external ear should be cleaned carefully, rendered antiseptic, insufflated with iodoform, and packed lightly with bichloride gauze. Should the fracture communicate with the nose or mouth, these cavities should be sprayed with hot water or a weak solution of boracic acid and the nose plugged with iodoform bichloride gauze.

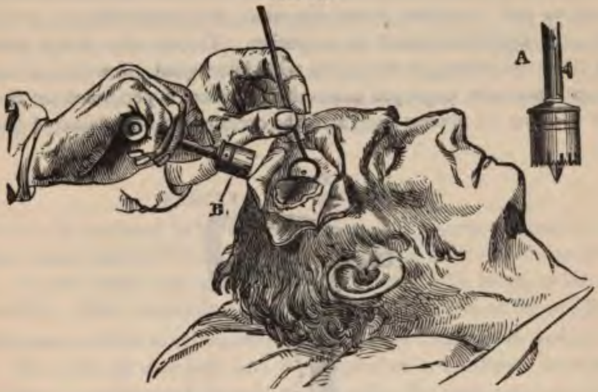
Rules for Trephining.

1. In simple fracture without depression, or evidence of compression, do not interfere; if symptoms develop, trephine.
2. In simple depressed fractures, without symptoms of compression, trephine.
3. In simple depressed fractures, with symptoms of compression, trephine.
4. In small, compound fissured fractures, without symptoms of compression, chisel a portion of the bone away on each side of the fissure for its entire length.
5. In compound depressed fractures remove the splinters, trephine, and elevate.
6. In punctured fractures, trephine.

Trephining.—The whole head must be shaved and a flap cut over the point of operation, horseshoe in shape, three inches in diameter, with its base, as a rule, downward, should be raised. The surgeon applies the trephine, which should be one and a half inches in diameter, with the point of his forefinger protecting the crown, and working it with an alternate pronation and supination of the wrist; and when it has made a circular groove deep enough to work it steadily, he must take care to withdraw the centre pin. He must saw steadily and cautiously, frequently examining the groove to ascertain whether he has reached the dura mater, and when he has done so he introduces the broad curved forceps to raise the circular piece of bone. The greatest care must be taken to fix the centre pin and the greater part of the circumference of the instrument on firm bone, and by no means press heavily while sawing on any piece of bone that is loose or yielding. When the saw reaches the diploë there will be an escape of blood with the bone dust, but there is no diploë in either children or aged persons.

When the piece of bone is removed the surgeon must gently insinuate the point of the elevator under that which is driven in, and using his finger, or the edge of the firm bone, as a fulcrum, slowly raise it to its proper level. All loose fragments having been removed and the wound sponged, the scalp must be carefully laid down.

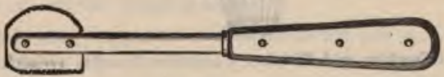
FIG. 16.



OPERATION OF TREPHINING.

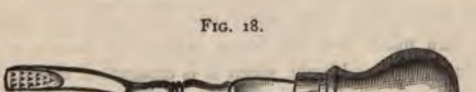
(A) Trephine prepared for use, with centre pin down. (B) Centre pin withdrawn, the under table having been divided.

FIG. 17.



Hey's Saw.

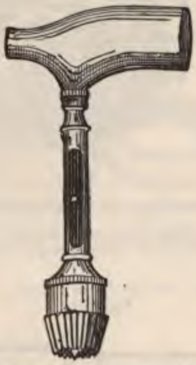
FIG. 18.



Elevator.

It is frequently necessary to open the dura mater. This is accomplished by seizing the membrane with a pair of rat-tooth forceps, drawing it away from the brain, making a puncture with the point of the operating knife, when a semilunar incision is made with a pair of probe-pointed curved scissors. Before closing the wound the free ends of the dura mater are to be brought together by a continuous catgut suture. When the button of bone is to be replaced, it should be put in a bowl containing 1 : 1000 solution of corrosive sublimate; the bowl to rest in a basin containing water at a temperature of 100° F. to 105° F., and kept there during the operation. The last steps of the operation are to close the wound in the scalp with interrupted silkworm-gut sutures. Drainage is not to be employed unless the operation is performed for the purpose of draining an abscess; or unless the operator fears exudation of blood or serum.

FIG. 19.



Conical Trephine, with Walsham's Improved Handle. (*Walsham.*)

INTERCRANIAL HEMORRHAGE.

Intercranial hemorrhage from injury may take place in three positions: between the dura mater and the bones, when it is known as extra-dural; between the dura mater and brain, when it is designated as sub-dural; in the brain itself, when it is called cerebral.

Extra dural hemorrhage is the condition most frequently encountered; it is due to the rupture of the middle meningeal artery or one of its branches.

In all these cases the patient is stunned by the effects of the injury; there is a brief period of unconsciousness, from which he recovers to again relapse. The period of consciousness followed by coma is most important; it is due to the intercranial hemorrhage taking place with more or less rapidity. Associated with the unconsciousness there is progressive paralysis. The pulse becomes frequent; respiration slow and stertorous; the temperature will rise from normal to 103° F. or 104° F. If the clot extend toward the base of the brain, the pupil upon the side where the extravasation takes place will be dilated and immovable.

The position of the clot is to be determined by the symptoms; when this is done, the patient is to be trephined at the site, the clot removed, and, if necessary, the vessel ligated. If after trephining over the middle meningeal artery it be found uninjured, the instrument should at once be applied over the posterior branch of that artery; if the wounded vessel is discovered it should be secured, the wound closed, and treated in the usual manner.

ABSCESS OF THE BRAIN.

This may be produced by blows or injuries such as compound fractures, or by a splinter being broken off from the inner table of the skull and driven into the brain. It may occur from pyæmia, septic disease of the lungs, or ulcerative endocarditis. Most commonly it is the result of suppuration of the middle ear.

Symptoms.—The most important and constant symptom is marked headache. The pulse is slow and full; the respiration is usually of the Cheyne-Stokes type; in some cases there is choked disk; the temperature as a rule is normal; chill is often absent, but occasionally present at the outset; epileptoid convulsions often occur; usually there are anorexia, vomiting, and general malaise; the bowels and bladder are evacuated involuntarily.

Treatment.—The abscess should be localized, the skull trephined, the abscess evacuated, and the wound drained.

Abscess following suppurative disease of the ear generally succeeds a chronic discharge and is usually situated in the temporo-sphenoidal lobe. As a rule there is a sudden cessation of the discharge, and at the same time nausea, vomiting, rise in temperature with pain in the mastoid region or neck, together with headache, which may be situated either in the frontal or temporal region. The tongue is dry and coated; there is diarrhœa; pulse is frequent; the temperature is subnormal; mind clouded, mental hebetude, passing into coma.

The skull should be trephined, the abscess opened, contents evacuated, and the wound treated antiseptically.

MICROCEPHALUS.

This is a condition where a child is born with the skull completely ossified, or where ossification has taken place soon after birth.

The operation for the relief of microcephalus is known as *linear craniotomy:* it is performed by making a longitudinal incision through the skin to one side of the sagittal suture, from the occipital bone to the hair line in front, and a transverse incision from the hair line downward. The flap is to be reflected back and a small opening made in the skull by means of a trephine; then with Keen's Rougeur Forceps a groove is cut as far forward as the angle of the wound in front; from this point a lateral groove is made. The parts are then irrigated, all hemorrhage controlled, and the flaps brought together by means of interrupted silkworm-gut sutures. In from six to twelve months a similar operation should be performed on the other side of the sagittal suture.

GONORRHŒA.

Gonorrhœa is a contagious purulent inflammation of the mucous membrane of the genitals of both sexes.

There are two varieties of gonorrhœa—the specific and non-specific. The specific is produced by a microörganism called gonococcus; the non-specific variety follows intercourse during the menstrual period, or when the female is suffering with leucorrhœa. It may also occur in persons affected with stricture, hypertrophied prostate, gouty diathesis, etc., etc.

The symptoms of each form are much alike; the non-specific variety has a tendency to run a short course, the patient convalescing in from ten days to three weeks. In rare cases it is as obstinate as in the specific form.

The time at which the disease usually appears after contagion is from twenty-four hours to ten days; the later it appears the less severe it generally is.

The patient first experiences a sense of titillation in the urethra, as if a drop of urine were contained in it. Upon examination, he finds that the lips of the urethra are red, and that there is a slight mucous discharge. Soon the urethra begins to be affected with considerable heat, and pain is experienced in voiding the urine, which is called *ardor urinæ*. The pain in many cases becomes excessively severe; there is an appearance of threads mixed with the urine. The next effect is a considerable diminution in the size of the stream of urine, the swollen state of the urethra contracting the calibre of the canal; it is often discharged in two or more streams, becomes forked, in consequence of the irregular and contracted state of the urethra, and is passed with much straining, pain, and scalding. At first the discharge is mucous, but after a little time it assumes a purulent appearance. The matter becomes yellow, and in some cases green, and it is frequently mixed with blood, so as to give the discharge a sanious appearance.

The disease does not confine itself to the beginning of the urethra, but extends along the course of the canal, and often produces inflammation of the glans and frænum, occasioning effusion into the prepuce and phimosis. The absorbent vessels on the dorsum penis often become enlarged and hard, and produce little abscesses.

In a first gonorrhœa the glands of the groin are often sympathetically affected, and become enlarged and painful.

Irritation and inflammation also take place in the corpus spongiosum, producing the painful state known as *chordee*. The penis is sometimes curved, and sometimes turned considerably to one side, and the groins, thighs, perineum, and testicles ache and feel tender.

After the inflammatory stage abates, a muco-purulent discharge remains, which, when obstinate and thin, is called *gleet.*

In the inflammatory stage of the disease there is often *irritation* or *actual inflammation of the urinary organs*, causing the most exquisite agony, or complete retention of urine. This inflammation may reach the bladder, giving the patient a desire to frequently pass water, and causing great pain in doing so.

There may be *hemorrhage* from the urethra; inflammation of the lymphatic glands of the groin, constituting bubo; *balanitis*, or suppurating inflammation covering the glans penis; phimosis, paraphimosis, or inflammation of the testicle in men or the ovary in women.

Treatment.—The treatment should begin with a free use of a mild sedative injection into the urethra. The bowels should be opened by some saline aperient. Abstinence from all alcoholic liquors should be enjoined; the diet should be very plain, and sleep should be procured by Dover's powder or other anodynes. The sulphocarbolate of zinc lotion, applied several times a day, is highly recommended by Mr. Wood. (See Formulæ 1 to 14.) *

If the patient is strong and plethoric, and suffers greatly from pain and fever, with pain in micturition, it is well to apply two or three leeches to the perineum.

The oleoresins of cubebs and copaiba should be administered when the case first presents itself. They should be given in doses of ten minims each three times daily; salol, fifteen grains, should be added to each dose. The oil of sandal wood also has a high reputation, but is best employed in the subacute and chronic stages.

The most usual mode of administering copaiba is in the form of emulsion, prepared by rubbing the balsam up with gum acacia, and adding camphor water and spirit of nitrous ether, to which a little tincture of opium may be added, or it may be given in capsules; great benefit is frequently to be derived from combining the copaiba and cubebs in the same emulsion. Painful erections and chordee may be relieved by a bag of cold water applied to the part; or a little mercurial ointment and extract of belladonna may be smeared on the part at bedtime, together with the free administration of the bromides, say from 20 to 60 grains, or of morphia in ¼-grain doses. The most reliable treatment is an injection of a four per cent. solution of cocaine, to be retained in the urethra from three to five minutes. Hemorrhage may be checked by cold water and ice pressure on the urethra at bedtime.

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* List of Formulæ at end of this volume.

ORCHITIS.

Acute orchitis, or acute inflammation of the testicle, may be caused by local violence, or it may occur in conjunction with gonorrhœa; and it is liable to be induced by employing injections and at the same time neglecting to use a suspensory bandage.

Symptoms.—If the patient is suffering from gonorrhœa the discharge will cease, and he will complain of aching pains in the testes and cord, followed by tenderness, swelling, fever, and frequently by vomiting. The part first and chiefly affected is the epididymis. The swelling arises mainly from an effusion of lymph and serum into the tunica vaginalis.

The symptoms of epididymitis closely resemble those of orchitis; in the latter the constitutional disturbance is greater, the local pain much more intense, and the patient does not assume the erect posture, but walks best with his legs apart. In orchitis the testicle is felt to be enlarged, globular, extremely sensitive, and tender. When the epididymis is inflamed it will be found above and behind the testicle, lying like a thick semilunar mass, threatening to overlap the testicle above, below, and at the sides.

Treatment.—Absolute rest in the recumbent posture; leeches over the cord, and opium at night, to allay pain. Purgatives, warm fomentations, and a suspensory bandage, to elevate the parts on the abdomen.

If injections are being employed they must be discontinued and iodide of potassium administered. When the swelling subsides and the discharge returns stop the medicine and put the patient on the use of the oil of sandal wood.

Punctures of the tunica vaginalis testes, with a tenotome, will frequently give immediate relief by evacuating the fluid.

When the acute stage has subsided, strapping, by the application of adhesive strips, should be employed.

Chronic orchitis may succeed an acute attack or it may arise spontaneously. The exciting causes are chronic cystitis, hypertrophy of the prostate gland, stricture, and gonorrhœa.

If the exciting cause is still in operation it must, of course, be removed; the tient should be confined to his back and put on the use of iodide of potassium; if this does not answer he should be mercurialized, using for the purpose calomel, blue mass, or protiodide of mercury. (See Formula 18.)

ACUTE PROSTATITIS.

Acute prostatitis is generally a consequence of acute gonorrhœa, but may be caused by stricture, impacted calculus, the passage of sounds or catheters, lithotrity, sexual excesses, or masturbation.

The **symptoms** depend upon the severity of the attack; there is a sense of weight, pain, and throbbing at the neck of the bladder, hardness and tenderness of the perineum; the gland feels swelled and tender on examination by the rectum, and there are frequent, violent, and painful efforts to make water. The stream is small and ejected without force; if the swelling and congestion become worse the urine will stop altogether. As the disease subsides a grayish, viscid, muco-purulent matter is voided with the urine.

The anxiety, distress, and fever rapidly increase as the disease progresses; there is tenesmus and constant sense of fullness of the rectum; the prostate can be felt projecting into it, which, hard and firm in the early stages, becomes soft and fluctuating if an abscess is formed.

The symptoms may subside gradually; the hardness and tenderness slowly disappearing, or the inflammation may become chronic, or suppuration may set in. The abscess may open into the urethra or into the perineum or rectum; or large chronic abscesses may form in the region of the prostate.

Treatment.—Place the patient in a hot bath and keep him in it until he begins to feel faint, giving him at the same time thirty or forty drops of laudanum; if relief is not obtained by this means, draw off the urine with a small flexible catheter. Apply leeches to the perineum, and then fomentations, or opiated poultices; administer an enema of starch, two ounces, laudanum; half a drachm, every night. Keep the patient in bed. If suppuration ensue, cut down through the perineum and drain the abscess.

CYSTITIS, OR ACUTE INFLAMMATION OF THE BLADDER.

Cystitis arises in consequence of neglected or ill-treated gonorrhœa, from gout, or from chronic inflammation induced by stone, stricture, or diseased prostate.

The **symptoms** are pain in the perineum, groin, or sacrum, tenderness of the lower part of the abdomen, frequent micturition, attended with great straining, followed by the aggravation of the pain with a mucous or muco-purulent sediment in the urine.

Treatment.—Begin with a calomel purge; if the pain is great, give opium or morphia by the mouth, or by enema, in sufficiently large doses to insure relief. Apply leeches to the lower portions of the abdomen or perineum; hot baths and warm fomentations. After proper depletion has been used, give diaphoretics; antimonial and saline mixture, with full doses of morphia or aconite. For irritable stomach, the effervescing draught is considered most preferable. When the urine is scanty, high colored, and acrid, nitrate of potassa or spirit of nitrous ether should be used. In the latter stages of the disease, give an infusion of uva ursi and hops, which may or may not be combined with morphia and bicarbonate of sodium, or morphia and balsam of copaiba, as circumstances may seem to warrant. (See Formulæ from 19 to 22.)*

STRICTURE.

Permanent **stricture** is caused by contraction of the urethra, usually from inflammation, infiltration of plastic effusion, and subsequent shrinking of this material and of the canal, with fibroid degeneration of the tissues around.

Strictures are classified as annular, linear, irritable, resilient, strictures of large and small calibre; permeable—that is, where an instrument can be passed through the stricture—and impermeable, where even the smallest instrument cannot be passed.

In some cases a small portion of the mucous membrane is found thickened and deprived of its natural elasticity, but in old, neglected cases the canal, with the *corpus spongiosum* around, will be converted into a thick, gristly mass, several inches in extent.

The most frequent *situation* of the stricture is a disputed point; most authorities place it at the bulbo-membranous junction.

The causes of stricture are repeated attacks of gonorrhœa, intemperance, unhealthy condition of the urine, and masturbation, which particularly affects the anterior portion of the canal. In the author's opinion, based upon considerable experience, the long-continued morbid erections that accompany gonorrhœa are potent sources of stricture.

Symptoms.—The patient finds that he wants to make water oftener than usual, with an uneasy sensation in the perineum after doing so; a few drops remain in the urethra and dribble from him after he has buttoned up.

Next he finds that the stream is smaller than hitherto, that it is forked or twisted, and that he requires a long time to pass his urine.

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* *List* of Formulæ at end of this volume.

Pretty soon the bladder becomes irritable, so that the patient is forced to rise in the night to void his urine, and is liable to attacks of spasm, with complete retention. Very often there is a gleety discharge, frequently found in the morning on waking up.

If the complaint continues, the health suffers, the bladder, ureters, and kidneys become diseased. The patient suffers from general debility and nervous prostration, and the urine is loaded with fetid mucus. Going from bad to worse, the patient will finally succumb to irritative fever or uræmic poisoning.

Treatment.—When the case is taken in hand early, the general health should receive prompt attention, and any disorder of the stomach, inflammatory tendency, or irritating condition of the urine should be treated.

The *mechanical* means to be resorted to are: Gradual dilatation, continuous dilatation, rapid dilatation, internal urethrotomy, electrolysis, external urethrotomy, internal and external urethrotomy combined, and perineal section.

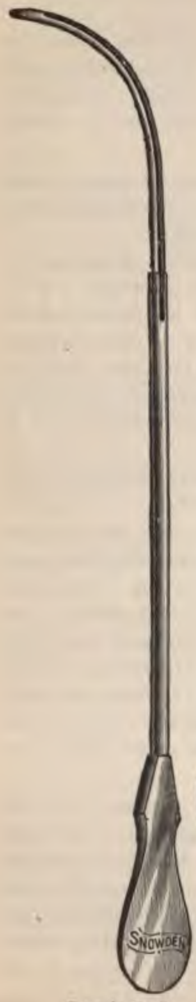
In order to determine whether the bladder or kidneys are diseased, and to decide the nature of the operation to be performed, the urine should be examined to ascertain the presence of albumen, pus, and the amount of urea present. Note should be made of the quantity of urine voided in twenty-four hours.

By means of the urethrometer and the exploratory bulbous bougie the number, position, and calibre of the strictures are to be established.

Gradual dilatation is employed in cases where the patient will not submit to a more radical operation, in recent cases before organization has taken place, in stricture of large calibre, and as a preliminary to other forms of treatment. The instruments employed are a conical steel sound and flexible rubber bougies. This method relieves the patient, but does not effect a permanent cure. The instrument employed should be passed every third day, care being taken to warm and oil it before introducing it into the urethra. It should be gently passed and gradually increased in size as pain and hemorrhage abate, until the normal size of the urethra is reached. It should not be passed oftener than once in three days.

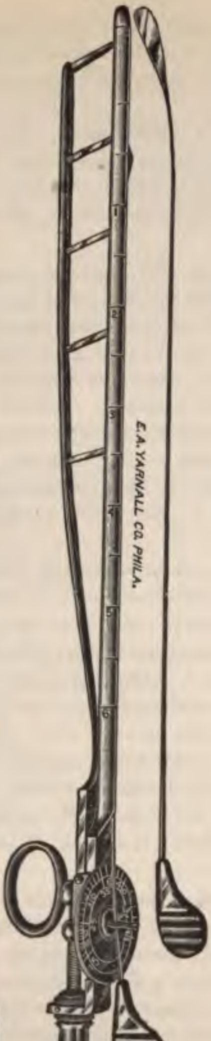
Continuous Dilatation.—This method is resorted to in cases of very tight stricture which will admit of the passage of a filiform bougie only. After being inserted and secured in place, it is allowed to remain for three days, at the end of which time a Thompson dilator, or a Goulay tunnel catheter can be passed over it and the stricture dilated. This method should not be employed where the patient suffers from retention of urine, which condition makes the case a proper one for external urethrotomy.

FIG. 20.



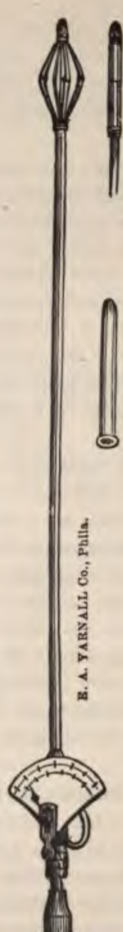
Syme's Staff.

FIG. 21.



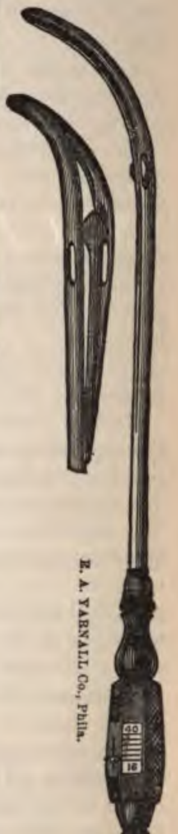
Otis's Dilating Urethrotome.

FIG. 22.



Otis's Urethrometer.

FIG. 23.



Gross's Dilator.

Rapid dilatation is best performed after the method pursued by Professor Brinton, which consists in properly preparing the patient by keeping him in bed three days prior to the operation, administering a gentle laxative so as to keep the bowels soluble, and giving him ten grains of boracic acid thrice daily. Let the patient have a light breakfast three hours before the operation. The urethra is washed out with 1 : 15,000 solution of bichloride of mercury, and he is given ten grains of quinine.

A filiform bougie is passed into the bladder and tied in place, where it is allowed to remain for three days, at the end of which time the patient is etherized, and a Thompson dilator, sterilized by heat, is passed over the filiform to the site of the stricture; the operator now grasps the dilator and the filiform in the right hand, passes the instruments together through the stricture, which must be dilated to the full size of the Thompson instrument, which, having been withdrawn, the Gross dilator is passed, and the urethra slowly brought to its normal calibre.

After this the canal is washed out with a warm boracic solution; a catheter is introduced, and retained in place for three days, at the end of which time it is removed and a full-sized bougie passed, which procedure is continued every three days for several weeks. The method here laid down is applicable to all cases of stricture which are seated in the membranous portion of the urethra, where the patient is not suffering from disease of the kidneys, where there is no fistulous opening into the perineum, and where it is not due to traumatism. Both Professor Brinton and the writer have performed this operation many times, and in every case with complete success.

Dilating Internal Urethrotomy.—This method is applicable to all strictures situated within three and a half inches of the meatus. The same precautions are observed in preparing the patient as those recommended in rapid dilatation. Having located the position and ascertained the calibre of the stricture, the Otis dilator is passed until it engages the obstruction, then dilate until resistance is met with, when the concealed blade is made to divide the stricture on the floor of *the urethra.* The urethrometer should be introduced to ascertain if the normal calibre of the urethra has been restored; if it has not, the urethrotome must be reinserted and the band further divided. The canal must be irrigated with bichloride solution, a catheter introduced, and allowed to remain three days. This operation cannot be performed if the stricture be under twenty millimetres; if the coarction is under this measurement, the calibre should be raised by means of a Maisonneuve's urethrotome up to 20 F., when the operation is to be completed by the Otis instrument.

Internal urethrotomy should not be performed in persons who are advanced in years, nor on those who suffer from an hemorrhagic diathesis or disease of the kidney. A bougie of the full size of the urethra must be passed every third day for at least one month after the operation.

External urethrotomy is advisable when there is a stricture so dense and unyielding, or so complicated with fistula, that internal urethrotomy cannot succeed, or where it is not possible to get a catheter into the bladder, from whatever cause.

In the first case Syme's staff is passed, and the stricture divided upon it. It is grooved on the convexity, and consists of two parts, of different diameters, which meet, with an abrupt shoulder, at the junction of the straight portion of the curve. The latter is the smaller of the two, so that it can pass through the contracted part of the urethra until it is brought to a standstill by the shoulder coming in contact with the face of the stricture.

The patient is placed in the lithotomy position, and a median incision made into the groove, taking care to divide thoroughly the whole length of the stricture. A probe is then introduced into the bladder to act as a guide, the staff withdrawn, and a catheter passed to make sure there is no further obstruction. When the wound is healing, bougies must be passed regularly. The new tissue that forms does not acquire the density of the old.

Internal and external urethrotomy is resorted to when the patient is suffering from stricture of the pendulous portion of the urethra, together with an impassable stricture of the membranous portion of the canal. The patient must be prepared in the usual manner, and dilating internal urethrotomy performed on the anterior stricture, whilst the one that is deep seated is divided by the method described under the head of external urethrotomy. After the operation the canal and bladder should be thoroughly washed out with warm boracic acid solution, a catheter passed through the meatus and brought out of the wound into the perineum. At the same time a drainage tube is to be placed in the bladder through the perineal wound. These tubes should be kept in place for four days, the canal and bladder being daily irrigated; at the expiration of this time the tubes are to be removed and a full-sized bougie passed. This must be continued for six weeks.

Perineal Section.—The urethra is laid open behind the stricture. The patient is placed in the lithotomy position, care being taken that he lies perfectly straight and the perineum is perpendicular. The operator sits in front, and with his left forefinger feels for the apex of the prostate. A long, straight knife, with its back toward the rectum, is then plunged steadily into the middle line underneath the bulb, so as to hit off the membranous part, or the apex of the prostate. A director is then passed into the bladder, and a soft catheter introduced and, if necessary, tied in. A preferable method is to make a careful dissection down to the urethra, open the canal and divide the stricture.

Electrolysis.—By this method an attempt is made to cure the stricture by means of electricity. For this purpose an urethral electrode is brought into immediate contact with the stricture. If any good is derived from this mode of treatment it is due to the continual dilatation produced by the electrode. This operation is frequently followed by such complications as urethritis, prostatitis, epididymitis, and affections of the bladder.

After giving electrolysis a fair trial, the writer is of the opinion that it should not be employed.

RETENTION OF URINE.

Retention of urine is an inability, whether partial or total, of expelling by the natural efforts the urine contained in the bladder.

Retention of urine may be due to causes acting on the urethra or the bladder. Calculus or other foreign bodies may become impacted in the urethra, tumors may press upon it, alterations in the walls of the urethra, either permanent, as stricture or enlarged prostate; or temporary, as congestion or spasm, may take place, or the bladder itself may be unable to expel its contents, from various causes, such as atony of its walls, paralysis, hysteria, disease of the spinal cord, peritonitis, exhaustion, alcoholic or other excesses, or shock.

Symptoms.—There is a hard and pyriform tumor in the hypogastric region, extending along the median line toward the umbilicus. The swelling is tender to the touch, which is greater if the bladder be inflamed; there is dullness on percussion; on account of the rigidity of the abdominal muscles there is inability to detect fluctuation by percussion; this is best elicited by introducing the finger into the rectum, placing it in contact with the bladder, and tapping the tumor.

The pain which the patient experiences soon becomes of a most excruciating character; the respiration is short and shallow; the desire to pass urine becomes more and more urgent, accompanied by tenesmus, rigors, alternating with flushes of heat, great thirst, hot and dry skin, restlessness; the urine is either not passed at all or comes away by drops or in a tiny stream.

After the retention has existed for two or three days there is involuntary incontinence of urine, which means that the bladder is over-distended, causing partial paralysis of the sphincter of the bladder.

If the patient is not speedily relieved, pains in the loins and tenderness over the kidneys supervene; there is headache, the pulse becomes weak, small, and rapid; there is urinous odor of the breath and perspiration, dry tongue, delirium, subsultus tendinum, coma, and death. Death occurs from uræmic poisoning in from four to five days. The bladder may rupture and empty its contents into the peritoneal cavity, giving rise to peritonitis or a gangrenous bladder, or abscess of the kidney may ensue.

Diagnosis.—Care must be taken not to confound retention of urine with pregnancy or ascites.

The **treatment** must be guided by a knowledge of the cause, but in all cases it is necessary to relieve the bladder as soon as possible.

If a calculus is impacted, means must be adopted to remove the obstruction; if the calculus is in the urethra where it can be felt, it may be worked forward by the finger until it reaches the orifice, where a small incision may be necessary; or it may be extracted with the urethral forceps. If it is fixed, or too far back, the skin over it may be stretched with the finger and thumb of the left hand, and a small longitudinal incision may be made on it. The wound must be dressed antiseptically.

A catheter should be passed immediately, if the symptoms are urgent; but if the patient can wait for half an hour he may be placed in a hot bath and given a full dose of opium or laudanum. The bowels must be thoroughly opened as soon as possible; the urine rendered unirritating by the use of alkaline carbonates, and sedatives and all stimulants forbidden.

If the distention of the bladder be excessive, all the urine must not be drained off at once; withdraw about one-half the first time and the remainder some hours after. Be careful to place the patient in a sitting or recumbent posture before commencing the operation.

Retention of urine may occur to individuals who are affected with gonorrhœa, and, thinking themselves well, have indulged in the pleasures of the table or in over-drinking. In such a case a soft, well-oiled catheter should be introduced, and afterward a hip bath should be ordered, together with a suppository of opium, three grains; extract of belladonna, half a grain. Perfect rest should be enjoined.

Newly-born infants may be affected with retention by reason of imperforate prepuce or imperforate meatus; in the former case it may be necessary to circumcise the patient, and in the latter cases a meatus must be made. Introduce a catheter if necessary. If it be due to a cyst in the sinus pocularis, as is frequently the case, it will be at once relieved by passing in a small probe and rupturing the wall of the sac.

In passing the catheter the patient lies on his back near the edge of the bed, the head being supported on a pillow and the knees separated from each other and slightly raised. The instrument should be about ten inches long, beak well rounded, eyes well beveled and smooth, and should describe the segment of a circle. Before introducing a catheter it must be warmed by friction and contact with the hand, and should be dipped in oil or vaseline. It should then be grasped with the index finger and thumb of the right hand; and, standing on the left side of the bed, raise the penis at right angles with the body, grasping it with the middle and ring fingers of the left hand, leaving the thumb and index finger free to retract the prepuce and separate the meatus. Hold the handle of the instrument in a line with the linea alba, its concavity being directed toward the abdomen, draw the meatus of the penis over the catheter, at the same time push the catheter into the meatus with the other hand. At about 5 or 5½ inches an obstruction will be encountered; when this point is reached, stop for a moment and withdraw the catheter about the eighth of an inch, and then raise the catheter over the obstruction, depressing the handle, when the catheter will glide into the bladder. If the resistance cannot be overcome, then desist in your efforts to introduce the instrument.

When the patient has stricture pass a nickel-plated conical steel bougie (No. 21, French; 12, English) into the urethra until the obstruction is reached; keep the back of the bougie gently pressed against the stricture, when after a little while the spasm will be overcome and the bougie will pass into the bladder; if it does not, next take an olivary-tipped bougie (No. 1, English; 3, French), which may be passed readily, then use successively larger bougies, and thus dilate the stricture.

If the stricture be a very tight one, inject the urethra with oil and introduce a filiform; when the obstruction is reached, gently rotate the filiform, until it passes onward into the bladder. *The filiform should always be employed before resorting to any other method of dilatation; if this rule be not observed the operator will be unable to pass that instrument.*

Now attempt to pass Goulay's tunneled catheter by threading it in its onward passage by the already introduced filiform.

The operator having failed to pass an instrument, suprapubic aspiration should be employed if the patient is in a weak condition; if, however, the patient be robust, recourse should be had to perineal section, with or without a guide.

Enlarged prostate generally occurs after the age of sixty. Care must be taken when retention occurs from this cause not to draw off all the urine at one time, nor to use a catheter with a long beak, lest the bladder contract on the instrument and inflammation result.

The instrument to be employed is that known as the Mercier prostatic catheter. If the passage of an instrument be found impossible, aspiration or suprapubic cystotomy should be employed.

TAPPING THE BLADDER.

When the catheter, bougie, and other means fail, aspiration, suprapubic tapping, or rectal tapping may be resorted to. In aspiration the instrument is passed about 1½ to 2 inches above the symphysis in the middle line, directing it downward and backward; this operation may be repeated two or three times a day.

In suprapubic tapping, make an incision along the middle line above the pubis, from an inch to an inch and a half in length, down to the connective tissue over the distended organ; through this opening the bladder is pierced at its lowest part by means of a long, curved trocar and cannula, the point of the cannula being inclined obliquely downward and backward. The cannula is retained by an appropriate bandage until it is desired to remove it.

Rectal tapping has been superseded by suprapubic aspiration. (See *Suprapubic Cystotomy*, page 254.)

HEMORRHAGE FROM THE URETHRA.

Hemorrhage from the urethra may be caused by the introduction of bougies, by a false passage, from internal injuries, by the separation of a slough formed by the caustic bougie, or by the rupture of a blood-vessel during acute chordee.

It may occur from general arterial excitement.

The recumbent posture, application of cold and pressure, should be tried. A flat piece of cork should be pressed by the patient against the perineum, far back, and gradually moved forward till it lights on the right spot, and the dripping of blood will cease. A solution of tannic acid in water may be used as an injection. Gallic acid may be of service.

A steel bougie, first put in very hot water and then introduced into the urethra, is often used to arrest this variety of hemorrhage.

If the hemorrhage is from the anterior portion of the urethra, insert a catheter, and apply a bandage firmly around the penis.

CHANCROID.

Soft chancre, or *non-infecting sore.*

This is a highly contagious suppurating ulcer, capable of being inoculated on the same patient; it is a local disease, and produces an ulcer wherever it may be introduced; unless *infected by syphilis*, there are no secondary symptoms; when the sore is thus infected it is called a mixed chancre.

This is the most common form of venereal ulcer, and is rarely met with except on the organs of generation. The usual period of incubation is from 24 hours to 10 days.

Symptoms.—During the first twenty-four hours there is simply an irritated spot or point which reddens; on the second or third day it swells slightly and becomes a pimple, surrounded by a red areola; from the fourth to the fifth day the secretion increases and becomes purulent, and the vesicle becomes a pustule with a depressed summit. After the sixth day an ulcer appears; its depth is equal to the thickness of the skin, its edges seeming as though cut with a punch, its surface covered with a grayish, pultaceous matter. The discharge is purulent; the sore is painful and is not hard. It lasts from three weeks to three months, and is attended with a bubo, which tends to suppuration.

Diagnosis.—The affections with which chancroid are most liable to be confounded are chancre, herpes, eczema, and balanitis.

Chancroid may be distinguished from *chancre* by its rapid development, its increased secretion, absence of induration, its tendency to multiplicity, and the difference in the period of incubation.

From *herpes* chancroid may be known by the former usually presenting itself on the head of the penis and prepuce in little vesicles, about the size of the head of a pin, occurring in groups, set closely together, of a whitish color and resting on a florid base.

In *eczema* the little vesicles are more minute and diffused than in herpes, and there is generally greater local irritation, the parts being swollen, hot, red, and itchy.

In *balanitis* the inflammation is usually widely diffused, the discharge being profuse, and of a thick, muco-purulent nature; there is no circumscribed ulceration, as in chancroid.

Simple ulcers, abrasions, or excoriations may occur on the prepuce and glans, and care must be taken not to confound them with chancroid.

Treatment.—In the treatment of chancroid S. D. Gross gives the preference to the application of the officinal solution of the acid nitrate of mercury, applied either pure or diluted, according to the exigencies of the case; an average strength is one part of the acid to eight parts water, applied with a piece of soft wood, the ulcer being first dried with a bit of cotton, and immediately after bathed in pure water; or, instead of the mercury, concentrated nitric acid may be used, so as to destroy the surface, the excess being carefully wiped off. The best application is carbolic acid; after this has been applied, the sore must be dusted with iodoform and dressed with absorbent cotton moistened with black wash.

When the acid nitrate of mercury or nitric acid is not used, hydrochloric acid may be applied; Vienna paste is highly recommended. Ricord prefers a caustic compound of sulphuric acid and powdered charcoal, united in proportions to form a semi-solid; of this mixture apply a thin layer to the chancroid and the adjacent parts; allow it to dry, when it will form a black, adherent crust, which, on dropping off, leaves a healthy sore, followed by rapid cicatrization.

The parts should be frequently bathed in warm water, containing a small quantity of acetate of lead or common salt.

The ulcer must be kept covered with lint, wet with a weak solution of tannic acid and opium, a weak preparation of yellow wash (bichloride of mercury, gr. j, to lime water, ℥j), sulphate of copper (gr. v, to water, ℥j), or black wash. Many surgeons apply a powder composed of calomel and subnitrate of bismuth, each one part, and carbonate of zinc two parts; first carefully washing the parts, and afterward keeping them wrapped in a solution of lead water and laudanum.

Should phimosis supervene, inject underneath the prepuce, every two hours, first cleaning out the parts by syringing with hot water, an injection of Goulard's extract, twenty drops; alcohol, thirty drops; water, one ounce. If the syringe cannot be passed under the prepuce, put the patient under the influence of an anæsthetic, and slit up the prepuce as far as the corona glandis, and then perform the operation of circumcision, being careful to treat the parts antiseptically, both before and after the operation.

If gangrene sets in—which is usually denoted by the appearance of a black spot, and by the prepuce becoming swollen and œdematous, and by subsequent sloughing—the patient must be placed under the influence of an anæsthetic, and the prepuce laid freely open; then dress with an ordinary simple dressing or an application of potassio-tartrate of iron, thirty grains to the ounce. The best application is a warm, moist, antiseptic dressing.

When the parts begin to granulate, it is best to apply the simplest dressings, such as opiate cerate, or ointment of red oxide of mercury, largely diluted with cosmoline.

The diet must be carefully watched; animal foods and stimulants avoided, the nourishment being plain and simple; cooling purgatives administered from time to time.

Pain and morbid erections are relieved by opiates, bromide of potassium, or chloral, together with soothing applications to the parts.

Serpiginous sores are those that wander over the surface of the thighs and abdomen, healing in one direction and spreading in another; one of the most efficient local remedies for this condition is saturated solution of potassio-tartrate of iron, applied on lint; or it may be necessary to use solutions of nitric, carbolic, or hydrochloric acid.

Opium should be given to allay pain. Quinine, mineral acids, iron, cod-liver oil, a liberal diet, exercise in the open air, and change of scene are the indications to aid recovery. (See page 37.)

CHANCROIDAL BUBO.

A bubo is an inflammation of a lymphatic vessel or gland, from any cause, but it is commonly restricted to the inflammation of the inguinal glands which accompanies a venereal sore or gonorrhœa.

A chancroidal bubo is an enlargement of the lymphatic glands of the groin, and is the result of the transference of the virus of the original sore to the groin; it may arise during the existence of a chancroid, from the absorption of its poison, and is likely to suppurate quickly.

Inflammation of the glands of the groin is a common occurrence, either after the local application of a poison capable of being absorbed, or after inflammation of the skin or mucous membrane, or without any special local cause, during a period of constitutional cachexia.

The chancroidal bubo is usually limited to one or, at most, two glands. Bubo depending on true chancre is likely to be multiple and indolent.

The bubo usually occurs on the same side as the primary sore; when the chancroid is situated near the mesial line a bubo may be developed in each groin.

Acute bubo pursues the course of acute abscess, with its attendant symptoms, shivering, pain, tenderness, swelling; the skin becomes red and thin, then matter points and is discharged; when the disease assumes this form, it usually runs its course rapidly, and is accompanied by severe constitutional disturbance. When the contents of the abscess are discharged, it is then called an open or *ulcerating* bubo, and the opening will be in the neighborhood of Poupart's ligament, either above or below, or partly above and partly below.

Indolent bubo occurs in persons of a weak and scrofulous constitution; after having made a certain amount of progress, it may remain stationary for some time, neither advancing nor receding.

Treatment.—In from two to three weeks after the appearance of a chancroid, in the proportion of about one case in four, a single lymphatic gland in the groin becomes swollen, painful, and tender; the overlying skin becomes red, œdematous, hot, swollen, and inflamed; a soft spot appears upon the swelling, and after a little while there is decided fluctuation, and an abscess is formed in the gland. As soon as the gland begins to swell and becomes tender, charge a syringe with the 1-500 solution of corrosive sublimate, or with a three per cent. solution of carbolic acid, and inject a few drops into the gland, and repeat this in different portions of the diseased structure until fifteen or twenty drops of the solution have been introduced. If this does not arrest the formation of pus, it will be necessary to wait, and when the pus is formed lay the abscess freely open.

If there is much inflammation, put the patient to bed, purge him, and place him on the mildest diet.

An operation is not to be performed until the gland has thoroughly softened.

Before opening the bubo the part is to be shaved and disinfected. The incision is to be made *parallel to the long axis of the swelling.* The pus must be entirely evacuated, when the cavity is to be washed out with a bichloride solution. The upper flap of the wound must then be seized with a pair of hæmostatic forceps, and cut away, using a pair of curved scissors for the purpose; the lower flap is then to be removed. Scrape the wound with a curette and remove all remaining portions of broken-down gland. When oozing has ceased, mop the entire surface with pure carbolic acid and pack the cavity with iodoform gauze. The part must be daily dressed.

SYPHILIS.

Definitions.—"Syphilis is an infectious, contagious, and inoculable disease, of slow evolution; it first manifests itself by an indurated or infecting chancre, afterward by eruptions of the skin and mucous membranes, later by chronic inflammations of the cellulo-vascular tissue and bones, and finally by special productions in the form of small tumors or nodules, which have received the name of gummata."—*V. Cornil.*

"Syphilis is a constitutional contagious disorder which may be acquired or inherited, the first manifestation of which, unless it be inherited, is a chancre." —*S. W. Gross.*

This disease is due to the introduction of a specific poison or virus from an infected person into the body of a healthy person, in which individual the poison is disseminated by the blood and gives rise to certain inflammatory lesions and new formations. It is usually transmitted by the secretions of a chancre, during impure sexual congress. An individual laboring under secondary syphilis can transmit the disease as readily as one affected with primary syphilis; the blood of a person laboring under secondary syphilis is inoculable; the flesh is likewise poisoned.

The secretion of what is known as the mucous patch is inoculable; it gives rise to chancre. If a female labor under secondary syphilis, any discharge which she may pour out from her uterus or vagina will give syphilis to a man having connection with her. Syphilis may be transmitted by other means than impure sexual intercourse, as by kissing a child with inherited syphilis, or by infecting the nipple of a nurse when the sucking child has mucous patches, or by smoking a pipe, or using a drinking utensil of an infected person, etc.

The symptoms of syphilis are divided into three stages: primary, secondary, and tertiary:—

Primary syphilis is the initial lesion or chancre, with enlargement of the associated lymphatic glands.

Secondary syphilis includes the more superficial inflammatory lesions of the skin, mucous membranes, and their appendages.

Tertiary syphilis comprises the destructive inflammation of the skin and mucous membranes and their appendages, as well as lesions of deeply-seated tissues of the various organs of the body.

CHANCRE.

Chancre is the initial lesion of syphilis.

Varieties.—A chancre may make its primary appearance simply as a fissure or crack; or as a papule from which the epithelium desquamates and re-forms, sometimes leaving a superficial hard base. It may present itself in the shape of a tubercle, or as a deep, indurated, excavated ulcer known as the Hunterian chancre. It may first appear as a crop of vesicles, which is the herpetiform variety of chancre. Then again there is the mixed infection, where the chancre and the chancroid are combined; this is very uncommon.

A chancre does not at once appear after a person has been inoculated. The minimum period of incubation of syphilis is ten days; the maximum period is ninety-eight days; the average period is twenty-one days.

Symptoms.—A chancroid may not appear until ten days, and a chancre never appears before ten days. In two-thirds of all cases the chancre makes its appearance as a superficial ulcer. It may present itself as a deep, funnel-shaped ulcer, or again as an elevated, hard, desquamating papule or tubercle.

Induration of the base of the ulcer is an important sign. The induration may feel, when moved about between the thumb and fingers, like thin parchment; or it may be a sore seated upon an indurated base about the size of a split pea; the induration may appear anterior to the sore, or *vice versa*. This induration is present in ninety-five per cent. of all cases. Whether present or not, if the disease be syphilitic, there will be found in the groin a number of very hard, distinct glands, rolling under the fingers.

In addition to being superficial, the ulcer is clearly cut, the edges are perpendicular, not undermined, and look as though made with a scoop. The secretion is serous. The sore is smaller than in chancroid; it is not attended with pain or inflammation. Its tendency is to heal.

The most common seat of chancre is on the glans penis, dorsal surface of the penis, the meatus, the anus, and lips in the male; and the labia, nymphæ, the entrance to the vagina, the fourchette, and the nipple of the female.

The ulcer will disappear in two or three weeks, leaving an induration which may last several months.

Bubo.—A constant concomitant of chancre is bubo.

If the chancre be upon the genitals, the glands of the groin will be found enlarged in ninety-five per cent. of all cases. It will be met with on the same side as the lesion; or, if the chancre be seated upon the median line, buboes will be found on both sides. If the chancre be upon the nipple the bubo will be found in the axilla. The bubo of chancre differs from that of chancroid in there being a number of swellings on either side instead of one; they will vary in size from a buckshot to a hazelnut; suppuration occurs in the proportion of one case in every twenty-seven; but in chancroid suppuration always takes place. The bubo will present itself in from eleven to fourteen days after the appearance of the initial lesion.

Treatment.—If an individual present himself soon after impure connection, with a slight abrasion or sore upon the penis, wash the part carefully, dry it with a soft cloth, and then dust it with a powder consisting of equal parts of calomel and finely powdered subnitrate of bismuth, covering it with a thin layer of cotton. Should the chancre not show a disposition to heal, apply any mild stimulating solution, as the red wash, nitric acid lotion, or a five- or ten-grain solution of nitrate of silver.

Never give mercury in the initial lesion of syphilis.

Local baths, either simple or medicated, are highly recommended. After bathing, the best local application is a moderately strong solution of acetate of lead, combined, or not, with opium, applied on soft lint or cotton wool, and covered with oiled silk. An elm poultice may be substituted.

Should phagedena present itself, it must be treated upon the same principles as would be observed in the disease occurring in any other ulcer. Destroy the sore by means of deliquescent carbolic acid. If the chancre be at the meatus keep the parts soft by a constant application of a mixture composed of melted mercurial ointment one part, white wax three parts. (See Formulæ 32 to 38.) *

SECONDARY SYPHILIS.

Secondary syphilis is that group of morbid phenomena which present themselves the first two years after the occurrence of an attack of primary syphilis.

Secondary syphilis is always preceded by chancre, and it may come on before the initial lesion has disappeared.

It is usually ushered in by well-marked constitutional phenomena; the patient feels uncomfortable and unwell; is irritable and desponding; countenance has a dull, muddy aspect; limbs and joints are sore and stiff; his appetite is impaired; his urine is scanty and high colored; is easily fatigued; has headache and disturbed sleep.

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* List of Formulæ at end of this volume.

After a few days he is seized with rigors, followed by high fever, or by fever and profuse sweats.

The attack is called syphilitic fever, and is an effort of the system to eliminate the poison.

The skin and mucous membrane, with the posterior cervical glands, are the parts most liable to attack.

Affections of the Skin.—Of these there are six varieties, viz.: the exanthematous, scaly, vesicular, papular, pustular, and tubercular.

Syphilitic eruptions are generally chronic; in form more or less circular, and usually copper colored; after having existed for some time they become of a grayish, muddy, or bronze appearance; usually appearing on the forehead, nose, cheek, back, and shoulder; they are accompanied or followed by grayish, hard and thick scales, greenish scabs, narrow cracks, or well defined ulcers.

In the *exanthematous* form the spots are pinkish, reddish, or of a pale copper color; they are most prominent on the trunk and extremities, and usually pass off with a slight desquamation of the cuticle. This eruption will make its appearance between the sixth and twelfth week after the appearance of the initial lesion.

As the eruption fades it loses its reddish tint, and assumes a dingy, dusky aspect. Duration from ten days to six weeks.

The *scaly variety*, or *psoriasis*, comes on from two to six months after the primary disease; it is always chronic, and is often associated with ulceration of the throat and palate, iritis, affections of the bones and joints.

The disease presents itself in thick scales of a dull grayish appearance. It may occur on any part of the body, but is most commonly met with on the forehead, scalp, face, forearms, palms of the hands, and soles of the feet.

The *vesicular variety* is very uncommon; it usually begins with minute, circumscribed pimples, scattered over the body, which are succeeded by a transparent, serous fluid, surrounded by a reddish, copper-colored areola. They are most common on the neck, chest, and extremities.

The *pustular variety* are circumscribed elevations of the skin, occupied by pus, and readily tending to ulceration. They range in size from a pea to an ordinary marble. They exist in great numbers; each pustule rests upon a hard, copper-colored base.

After a time the contents of the pustule escape, concrete, and form hard, thick scabs, of a dark brownish color, firmly adherent.

The *papular* syphilis or *lichen* is distinguished by the appearance of small, hard, solid elevations, containing no fluid, and generally terminating in desquamation, seldom in ulceration. This affection may be acute or chronic.

The *tubercular* form of syphilis exists in two varieties; in the first the eruption consists of small, red, copper-colored eminences, varying in size from a small bird shot to that of a pea; they are smooth and polished, and soon become covered with a dry, scaly crust.

In the more aggravated form the tubercles are larger, of a deep violet color; after continuing for a longer or shorter period they inflame, suppurate, and are replaced by deep, foul, painful ulcers.

Loss of hair from the scalp, eyebrows, and lids is common as an early symptom. When the system is saturated with the virus, the beard and the hair of the rest of the body may also disappear.

Affections of the mucous membranes are liable to appear within four or five weeks after the initial lesion.

The parts usually affected are the tonsils, palate, pharynx, tongue, cheek, and lips. Well-marked signs of the disease frequently appear at the anus and lower part of the rectum, upon the foreskin and head of the penis of the male, and upon the vulva, vagina, and uterus of the female.

Secondary affections of the mucous tissue occur in various forms, as an erythematous disease, as a tubercle, or as an ulcer. Syphilitic *erythema* occurs most frequently in the throat, affecting the arches of the palate, uvula, pharynx, and sometimes the root of the tongue.

The inflammation is either diffused, or it occurs in distinct mucous patches of a circular or oval form; it is of a copper color.

Ulcers of the throat generally make their appearance on the uvula and tonsils, arches of the palate, and back of the pharynx.

The superficial ulcer is either simply an erosion, or a cavity with well-defined, ragged edges, rather sharp and somewhat undermined. It usually presents itself early after the primary sore.

In the excavated ulcer the edges are steep, everted, or ragged, and are surrounded by a hard, inflammatory, copper-colored base; the discharge is thin and ichorous; the sore is most distinctly marked on the tonsils. They are liable to take on phagedenic and gangrenous action, and extensive destruction of the soft palate frequently results. The excavated form of the disease is usually accompanied by extensive swelling, together with great pain and difficulty in swallowing. Mucous *tubercles* generally occur upon the tongue, lips, inside of the cheek, tonsils, and palate; they are slight elevations of the mucous surface, usually of an irregular oval or elongated shape, and of a whitish hue.

The **treatment of secondary syphilis** should be hygienic, tonic, and specific. The patient should be careful not to eat indigestible food; he should take exercise in the open air at stated periods, not to the point of fatigue; his habits should be regular; he must discard the use of tobacco and alcoholic drinks, unless he be an habitual drinker, when he should diminish the quantities hitherto taken. He should take a tepid bath every night before going to bed.

When the patient is greatly debilitated, and the blood is watery, a tonic treatment is to be resorted to.

The specific plan of treatment consists in the proper administration of mercury; the bichloride is usually preferred, combined with the tincture of the chloride of iron. The mercury thus acts as a tonic, and also by destroying the specific virus of syphilis.

It is necessary to begin with very small doses of the mercury until the susceptibility of the patient is determined. The rule is to avoid anything like the approach of ptyalism. After each dose of the remedy the mouth should be thoroughly washed out with a solution of chloride of potassium, in the proportion of twenty grains to an ounce of water.

Mercury may be administered by the mouth, stomach, inunction, fumigation, by the rectum, or hypodermatically.

If the patient be weak, debilitated, and suffering from an impaired condition of the blood, it is well to combine a tonic plan of treatment with the mercury; a good combination is blue mass two grains, sulphate of quinine and sulphate of iron each one grain, opium a quarter of a grain, given three times within the twenty-four hours. The following is highly recommended: bichloride of mercury three grains, tincture of the chloride of iron two ounces; of this give twenty-five drops in a wineglassful of sweetened water three times daily. If the patient be in ordinary health, give him a pill of one-fifth of a grain of protiodide of mercury, with one twenty-fourth of a grain each of tartar emetic and sulphate of morphia; Dover's powder may be substituted for the morphia. In prescribing this remedy it is necessary to test the susceptibility of the patient; in order to do this give one of the pills half an hour after each meal; at the expiration of two days add a second pill to the mid-day dose; if this does not produce griping or diarrhœa, add a third pill; making one pill after breakfast and supper and three pills after dinner; should the patient become griped, fall back to three pills daily.

If an extremely speedy action of mercury is required, as in the case of iritis and in malignant syphilis, the remedy should be used hypodermatically; the following is the best formula: bichloride of mercury one-tenth of a grain, hydrochlorate of cocaine half a grain, water fifteen minims.

If mercury produces griping and diarrhœa, then it will be necessary to resort to inunction; use for the purpose equal parts of twenty per cent. oleate of mercury and cosmoline.

If for any reason inunction is not advisable, then resort to fumigation. Finally, mercury may be given by the rectum.

Keep the patient upon the combination of protiodide of mercury and morphia for two months after all lesions have disappeared, then stop the remedy for two weeks; recommence, but diminish the amount of mercury one-third;

keep the patient on this for another two months, then intermit for from two to four weeks; then return to the treatment, keeping it up for two years. After the expiration of this period let the patient return to the surgeon every two weeks for the next eighteen months, in order that he may remain under observation.

If at any time during the treatment of secondary syphilis a lesion of tertiary syphilis makes its appearance, iodide of potassium must be combined with the mercurial treatment; when the tertiary symptoms disappear, omit the iodide of potassium.

If a papular eruption presents itself, anoint the parts with a five per cent. oleate of mercury, to which any aromatic oil may be added; or an unction may be used of ammoniate of mercury half a drachm, cosmoline one drachm.

To remove the crust in impetigo, apply an antiseptic poultice; when it has become sufficiently softened use a preparation, spread upon lint, composed of ointment of nitrate of mercury one drachm, cosmoline seven drachms.

When there is a moist papular eruption of the skin, with an ulceration of the epidermis, the parts should be carefully washed three times a day with tepid water and chromic acid, or a weak solution of corrosive sublimate and water should be applied once during the twenty-four hours; in the interval the parts are to be dusted with a powder of one part calomel, two parts oxide of zinc; then lay over each papule a piece of absorbent cotton.

When the patient is threatened with *alopecia*, the hair should be cut short, and mild lotions of alcohol and aqua ammonia should be applied, or alcohol glycerine, and tincture of cantharides may be used, or a wash composed of tannic acid gr. vj, sulphate of copper gr. ½, bay rum and water each an ounce; or tincture of cantharides two drachms, aromatic spirit of ammonia half an ounce, rose water four ounces, and corrosive sublimate four grains.

Iritis, which occurs in the advanced stages of syphilis, must be treated early and vigorously. The patient must be promptly brought under the influence of mercury, as the disease usually affects both eyes and extends rapidly to the cornea, choroid, and retina. Give calomel one grain, opium half a grain, three times in twenty-four hours. As soon as the gums become slightly tumid and there is salivation, cease to administer the remedy. The action of the mercurial may be hastened by applying a mercurial inunction.

A solution of atropia, four grains to water one ounce, is to be dropped into the eyes. If there be great pain apply eight or ten leeches to the temple. To relieve the pain, opium in combination with a diaphoretic must be administered; say Dover's powder grs. v, or sulphate of morphia gr. ⅙, every five or six hours.

The most suitable local remedies to the mucous surfaces are nitrate of silver in substance, or acid nitrate of mercury variously diluted. When the part is ulcerated the preference is given to the acid nitrate of mercury, diluted with eight or ten parts of water.

Nitric acid, carbolic acid, or hydrochloric acid, properly diluted, may be used as substitutes for the acid nitrate of mercury.

Gargles composed of pyroligneous acid ʒij, water ℥viij, honey a sufficient quantity; or subacetate of copper and tannic acid; or tannic acid and glycerine; or nitric acid and chlorinated sodium, may all be advantageously used in turn. (See Formulæ from 39 to 44.)*

TERTIARY SYPHILIS.

By the term tertiary syphilis is generally understood the lesions of the disease which show themselves, as a rule, after the expiration of two years from the commencement of the primary sore.

They consist of deep, destructive ulceration of the skin and mucous membranes, the occurrence of a form of tumor called gumma, of fibroid induration and thickening of the organs and their capsules, and of obliterating inflammation of the lining membrane of the arteries.

The textures most prone to suffer in tertiary syphilis are the connective tissues, mucous membranes, periosteum, bones, fibro-cartilages, aponeuroses, tendons, and testicles.

The most common of the internal lesions are gummy tumors, foul, ragged-looking ulcers, softening and pulpy degeneration, and tubercular deposits.

The most important and frequent lesion of tertiary syphilis, and which may be looked for in from two to five years after the appearance of the primary lesion, is the gumma, so called from its gummy discharge when it is broken down. It is a tumor made up of granulation tissue; it is more or less spherical in shape, of hard, elastic consistence. Gummata may be ulcerating or non-ulcerating. Gummata are found most frequently in connection with the skin, subcutaneous tissue, muscles, bones, periosteum, liver, brain, lungs, and testicles.

Tertiary syphilis is very common in the brain and spinal cord, and shows itself in a variety of ways; it gives rise to epilepsy, locomotor ataxia, paralysis of one or both of the facial nerves, hyperæsthesia, and affections of the nerves of special sense.

In *tertiary syphilis* the lesions of the skin differ from those of secondary syphilis in being destructive, affecting the deep layers; the most common form are the tubercular, which are apt to undergo destructive ulceration; the deep pustular; the impetigo, the ecthymatous, and the rupial eruptions.

The affections of the mucous membranes consist in the occurrence of ulcers, and of mucous patches about the mouth.

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* List of Formulæ at end of this volume.

The *eyelids* are frequently attacked by the disease; it generally shows itself as an indurated ulcer of an oval shape; the borders are inflamed and thickened, and the conjunctiva is usually inflamed.

Affections of the periosteum and bones present themselves in the form of nodes or gummy tumors, inflammatory hypertrophy, exostosis, caries, and necrosis. These affections may come on at any time after eighteen months from the first affection. They are most liable to occur in persons of a scrofulous habit, or whose constitutions have become impaired from any cause.

The bones affected with tertiary syphilis are those that are superficial, or least protected by the soft parts, as the tibia, fibula, ulna, clavicle, and bones of the skull, nose, palate, and upper jaw.

Nodes occur usually upon the tibia, ulna, clavicle, frontal and parietal bones.

They are usually circumscribed, semi-solid swellings, of an ovoidal shape, and of a slightly elastic touch.

The periosteum and bone are inflamed, softened, and ulcerated, and as the tumor extends, the structures over the seat of the disease become red and painful, and ulceration finally takes place at the most prominent point.

The course of the disease is chronic, and it is attended with an intermittent, neuralgic pain, greatly increased at night.

Caries is most common in the long bones of the extremities, in the skull, and in the palate, maxillary, nasal, turbinated ethmoid bones, and vomer.

Hypertrophy of the osseous tissue is exceedingly common, and may involve many of the bones; those most liable to be attacked are the tibia, fibula, femur, ulna, radius, and cranium. The tumor is usually knotty and irregular, with a broad base and a rough, scabrous surface; in long standing cases it becomes hard, and of the consistence of ivory.

Treatment.—Iodide of potassium, given in solution, is the remedy most frequently resorted to in tertiary syphilis; fifteen grains three times a day is a medium dose, but it is often given in much larger quantities; it should be taken about an hour after eating.

Iodide of potassium is generally combined with carbonate or muriate of ammonium, or iodide of sodium, or iodide of ammonium; the average doses of these remedies is about eight grains; their efficacy will be enhanced by the addition of a small quantity of mercury; the form of mercury usually preferred is the bichloride, in doses of $\frac{1}{16}$ to $\frac{1}{8}$ of a grain, three times daily. A good substitute for the bichloride, should it disagree with the patient, will be found in the biniodide.

In treating tertiary syphilis it is to be remembered that the iodides will only temporarily remove the lesions of this malady, but they will not prevent recurrence, hence mercury is usually given in combination. It should be persisted in for at least six months after all evidence of the disease has disappeared, and after the iodides have been stopped.

Donovan's solution is a remedy in general use, the dose being from five to eight drops. Tonics, as a rule, are indicated; quinine and iron are usually preferred.

Sudorifics are highly praised when there is obstructed perspiration; Dover's powder, antimony, morphia, warm or steam bath, are the remedies usually recommended.

Anodynes are most valuable auxiliaries, it being of vital importance to produce sleep and to quiet the nervous system; morphia, laudanum, black drop, or opium must be used in sufficiently large quantities to answer the indications.

For ulcers, fissures, eruptions, etc., the topical treatment generally in use are weak solutions of nitrate of silver or acid nitrate of mercury; when there is much inflammation present, acetate of lead and opium may be employed.

Syphilitic *onychia* is best treated by the application of nitrate of lead, sprinkled over the sore three or four times daily.

Tertiary ulcers of the throat, mouth, and *tongue* are most beneficially treated with applications of acid nitrate of mercury or solid nitrate of silver. Weak gargles or washes of acetic acid, tannic acid and sulphate of copper, chlorinated sodium, may be employed in the intervals.

For *syphilis of the nose*, injections of weak lotions of iodide of iron, sulphate of copper and tannic acid, tincture of myrrh, permanganate of potassium, and chloride of zinc are most to be relied upon.

The remedy for syphilitic *iritis* is mercury pushed to rapid ptyalism.

For ulcers of the *eyelids*, use iodide of potassium, and apply dilute ointment of nitrate of mercury.

The pain in the bones is relieved and swelling abated by applying tincture of iodine, leeches, and blisters. If the ulcer is slow to heal, apply a blister and dress it with mercurial ointment.

If a gumma makes its appearance somewhere on the subcutaneous connective tissue, besides relying upon the specific mixed treatment already laid down, make an application to the part of tincture of iodine two or three times daily; if it be on the hand or arm, place the limb upon a splint, apply the tincture of iodine, and make compression with a bandage.

If the gumma be already opened when first seen by the surgeon, apply the usual dressing of corrosive sublimate solution, and when the gummy matter has been excluded, apply some stimulating lotion. Iodoform collodion is highly recommended. (F. 96.)

Inherited Syphilis.—If a mother is affected with secondary syphilis, she should be placed upon specific treatment as soon as she is found to be pregnant.

The child, when born, should be placed upon the mercurial plan of treatment. It should be given one grain of mercury, with chalk, rubbed up with sugar, twice a day, gradually increasing to two grains a day. One-fifteenth of a grain of Dover's powder may be added to each dose if the mercury disagree with the child; or the mercurial may be introduced into the system by inunction, by smearing the end of a flannel roller with five per cent. oleate of mercury and carrying it around the abdomen.

TUMORS.

Lücke defines a tumor to be "an increase in volume, by the growth of new tissue, which does not perform any physiological function."

Tumors are divided into neoplasms and cysts.

A **neoplasm** may be defined to be a circumscribed tumor, constituted by a mass of more or less newly-formed tissue, which represents a local overgrowth, and a permanent addition to one of the normal tissues of the body.

Neoplasms assume various shapes. They may appear as a flat swelling, or they may rise high above the level of the skin, when they are called tuberous tumors, the base being wider than the summit. Other varieties of tumors are the elongated, the papillary, the fungous, and the polypoid. When a papillary tumor is on the mucous membrane, it is of a villous growth.

A *tumor* is the result of hypertrophy of the tissue; hence the growth of a neoplasm is due to nutritive disturbance. An increased amount of blood is sent to the part, and in consequence of the increased nutrition, the cells undergo proliferation.

In the formation of a tumor the cells alone are involved, which is not the case in inflammation. The blood-vessels are not involved in the change that takes place in the growth of a tumor, save to nourish it.

All tumors are the direct product of preëxisting cells, and are supplied with vessels, nerves, and lymphatics in varying degrees of abundance. The three leaflets derived from the blastodermic membrane of the embryo give rise to their own peculiar cells.

A tumor does not spring directly from a connective-tissue cell, but the structure in which a tumor is forming undergoes proliferation, and as a result the tissue itself reverts to a mass of young cells called embryonic tissue. This condition is known as the *indifferent stage;* it is impossible to foretell what character of tumor is about to form.

In the formation of a tumor there is nothing entering into its composition that is foreign to its organism. Neoplasms have their prototypes or analogues in the normal tissue, and upon this fact is based the anatomical classification of tumors.

The rapidity with which tumors grow depends upon the nature of the growth, on the condition of the organ affected, and on the age of the patient attacked.

Tumors are subject to disease just as are healthy structures, and may undergo the same pathological changes. They are also subject to inflammation. Interstitial hemorrhages are common to some tumors; they may ulcerate, either as the result of injury or of natural tendency.

Women are more liable to tumors than men, as are also the dark races and the inhabitants of hot countries. In certain families the tendency seems to be hereditary. Young persons are more liable to tumors of the connective-tissue type, and the aged to the epithelial.

Tumors are divided into three classes: those that are composed of and are derived from the connective tissue, as lipoma; those which are derived from and are composed of the higher connective tissue, as myoma; and those that are derived from and are composed of the epithelial structure, as papilloma.

Those tumors that are derived from connective tissue are divided into *benign* and *malignant.*

Typical tumors are those benign tumors of the connective-tissue class which conform to the type of normal tissue, and follow in their growth a determined model.

Homologous tumors are those which resemble the tissue of the matrix, or the tissues from which they grow. A chondroma growing from cartilage is an example of an homologous tumor.

Heterologous tumors are those which in their histological construction bear no resemblance to the tissue or parent structure from which they grow. An osteoma growing from connective tissue is an example of this kind of tumor.

Type. A tumor may change its type. A papilloma may be converted into an epithelial carcinoma; a pigmented nævus may change with advancing years into a sarcoma. Different kinds of tumors may be found on a patient at the same time.

The Causes of Tumors are obscure; they are divided into *predisposing* and *exciting.* A predisposing cause is hereditary transmission. Exciting causes may arise from local irritation, as when epithelioma results from a jagged tooth tearing the mucous membrane of the cheek or tongue. The smoking of a short clay pipe frequently produces the same disease.

BENIGN TUMORS.

Symptoms of a Benign Tumor.—The marks of a benign tumor are: they are circumscribed and movable, and not blended with the surrounding structures, and, although multiple, they are found in the same tissue; they are compatible with good health, though by enlargement they may cause œdema or paralysis by pressing on arteries or nerves, or they may distend the skin, and so may ulcerate and slough; these are local consequences, and cease if the tumor be removed; and if effectually removed they do not return.

Examination by the microscope reveals the fact that they are composed of a structure which resembles the normal adult tissue. Benign tumors are capsulated. A simple tumor pushes aside or presses upon the surrounding structures; it does not infiltrate them, hence they do not recur when removed. They never give rise to metastatic deposits, and they generally grow slowly. They rarely attain any considerable volume; exceptionally they attain great size. They do not become adherent to the overlying skin, as is frequently the case with malignant neoplasms.

The benign growths representing the matured connective tissue are—

Lipoma—*Fatty tumor.*
Fibroma—*Fibrous tumor.*
Chondroma—*Cartilaginous tumor.*
Osteoma—*Bone tumor.*

The tumors derived from a higher type of connective tissue are—

Angeioma—*Vascular tumor.*
Neuroma—*Nerve tumor.*
Myoma—*Muscular tumor.*

Lymphoma—*Lymphatic tumor* (*fibrous*).
Lymphangeioma—*Lymphatic vessel tumor.*

LIPOMA,

or *fatty tumor*, consists of fat tissue intersected in the meshes of fibrous bands and contained in a fibrous capsule.

They are soft, movable, and lobulated, sometimes semi-fluctuating, or fleeting, like fat, half fluid at the temperature of the body and free from pain and tenderness.

Their most usual situation is the subcutaneous tissue of the trunk, especially about the back of the neck and shoulders.

FIBROMA,

or *fibrous tumor*, consists of fibrous tissue; sometimes white, glistening, and hard, resembling tendon, and at other times softer, yellowish in color, and containing fat within its meshes. There are two varieties, the *hard* and the *soft*. The hard are mostly found in connection with the periosteum, the fascia, and the nerve sheath; the soft in the skin and submucous tissue.

CHONDROMA,

or *cartilaginous tumor*, consists, for the most part, of cartilage, identical with normal cartilage. They are firm and smooth; as a rule they are somewhat nodulated; they may be hard, but sometimes are so soft as to be taken for cysts. Their usual situation is on or within the bones, particularly those of the hands; if developed within the bone, they will cause it to expand into a thin shell.

Their growth is usually slow; they are more frequent in early life. They are often multiple and hereditary. When thoroughly excised they do not return, though to this rule there are numerous exceptions.

OSTEOMA,

or *bony tumor*, is generally circumscribed, rounded, and flattened, pedunculated, more or less irregular in size and shape. The most common form is *exostosis*, generally found at or near the articular extremities of the long bones. They frequently exist on the dura mater; they have also been found on the larynx, bronchi, and muscular substances. Their growth is exceedingly slow.

MYOMA,

or *muscular tumor*. Tumors of the unstriped variety occur chiefly in the uterus; they are also found in the œsophagus, stomach, and prostate gland, as well as in the scrotum of man and the labia majora of woman.

LYMPHOMA,

the lymph gland tumor, consists of lymphatic tissue. It is found everywhere on the body; it essentially consists of a delicate network formed by the branches of stellate cells, containing elements similar to those of chyle or lymph.

ANGEIOMA,

or *vascular tumors*, are vascular growths which consist of active hypertrophy, or extension in length and calibre of existing vessels with the growth of new ones. The two chief varieties are the simple angeioma (nævus) and the cavernous angeioma (erectile tumor).

NEUROMA

or *nerve tumor*, consists of hypertrophied nerve tissue; is most rare, except as evidence of an abortive attempt at union of a divided nerve, when the divided ends retract and become bulbous. They may become exceedingly painful and require to be cut out.

INFECTIVE GRANULOMATA.

Infective granulomata are a class of neoplastic formations which, in certain stages of their growth, are tumors, but are not classed as tumors because they are ephemeral, or not permanent, and disappear by resolution or by ulceration. They are made up of granulating tissue, and their infective character is due to a specific microbe. Glanders, syphiloma, tubercle, leprosy, and lupus belong to this class of tumor.

The infective granulomata are locally and generally infectious; they give rise to like tumors on different organs and tissues of the body. Some forms are inoculable; they are contagious, but they do not form permanent additions to the body; they are, therefore, excluded from the consideration of neoplasms.

MALIGNANT TUMORS.

Symptoms of Malignant Tumors.—Malignant tumors tend to infiltrate and become blended with the adjoining parts; they cannot move freely, and they adhere to the skin over them; they are frequently of rapid growth and are very painful. Unless completely removed they return in the same place. Their recurrence is owing to the fact that cells of the diseased tissue are left behind at the time of the operation. Some cells travel along the lymphatics and affect the nearest glands; others are diffused over the body by means of the blood-vessels.

They infect the lymphatic glands and frequently give rise to secondary deposits in the various viscera.

A malignant tumor may ulcerate and become fungous, when it is very liable to bleed. An anæmic condition, denominated cachexia, accompanies the disease. The less the tissue of a tumor resembles the normal adult tissue, the more malignant it is apt to be.

At the outset a malignant tumor is a local disease; the first characteristic of malignancy is manifested by infiltration into the surrounding tissue.

A malignant tumor may be capsulated, but as a rule the capsule soon becomes infiltrated by the cell growth of the tumor, and is blended with it.

In carcinoma and in alveolar sarcoma the infection takes place through the medium of the lymphatics. In sarcoma and myxoma the secondary tumors take place through the medium of the blood-vessels. These metastatic tumors are the exact likenesses of the original growths.

Scale of Malignancy.—The least malignant of the carcinomatous group is a form of epithelioma called the rodent ulcer. In the scale of malignancy are the epithelioma, colloid, scirrhus, and encephaloid Of the sarcomata the least malignant is the giant cell; the next is the small, spindle-shaped sarcomata; then follows the small round-celled sarcoma, and finally, the most malignant is the alveolar. In sarcoma, the smaller the cell the more malignant is the disease.

Tumors are malignant because of their structural peculiarities and of the changes that take place in the tissues that immediately surround them. If a tumor is single at the outset and afterward becomes multiple, it is malignant; but if the tumors are multiple at the beginning, and if they are found in the same tissue, they are benign.

Malignant Tumors (Embryonic Connective Tissue Type).—The next division of connective tissue tumor is that which is derived from and corresponds to the embryonic, transitional, or unripe connective tissue. Tumors belonging to this class are denominated *Atypical*, and are included in the term *Sarcoma*. They are—

Round-celled Sarcoma.
Spindle-celled Sarcoma.
Giant-celled Sarcoma.
Mixed-celled Sarcoma.

The small, round, spindle-celled sarcomata are called encephaloid; if these tumors should be infiltrated by hematoidin, giving rise to a dark brown or black pigmentation, they are called melanotic; the tumor made up of the giant cell is called myeloid sarcoma; this form is generally maroon colored.

Modified forms of the four varieties of sarcoma are not uncommon; the most important are the *alveolar*, and the *glioma*, sometimes called *neuroglioma*.

Among the tumors of this class is a growth which also occurs in the mature connective-tissue group, viz., the medullary lymphoma, or soft variety; this is the only exception to the rule that malignant tumors bear no resemblance to normal tissues of the body.

The other important modified forms of sarcomata are the—

Fibro-Sarcoma,
Lympho-Sarcoma,
Chondro-Sarcoma,
Osteo-Sarcoma,
Myo-Sarcoma.

MYXOMA.

As a rule the mucous tumors are innocent, but the purest form of myxoma, in which little or no development takes place, and which, therefore, corresponds with sarcomata in the fact that they are embryonic tissue tumors, are, as a rule, as malignant as sarcomata of the same tissue or organ. Those which are developed in the substance of fatty or fibrous tissues, and which may be regarded as ill-formed fatty or fibrous tumors are not as innocent as simple fibrous or fatty tumors.

BENIGN TUMORS (EPITHELIAL TYPE.)

The typical epithelial tumors, that is the varieties based upon the model of preëxisting tissue, are those tumors which are developed in the skin, mucous membranes and their appendages.

1. **Papilloma**
    - Horn,
    - Corn,
    - Wart,
    - Villous growths.
2. **Adenoma.**

Villous growths are found upon the mucous membranes of the body.

Atypical epithelial growths resemble no other growths in the body; they are called carcinoma.

PAPILLOMA

is an hypertrophy of the papillæ of the skin and mucous membrane. The most common form is the ordinary wart, which consists essentially of elongated and enlarged papillæ. Horny growths constitute another form, and appear to originate in the sebaceous follicles, by proliferation of their epithelial lining.

ADENOMA

is the term by which all glandular tumors are designated.

They generally grow very slowly; are not painful; are firm and elastic, freely movable, the adjacent skin being unaltered. On cutting into them they present a lobed construction not unlike an indurated pancreas.

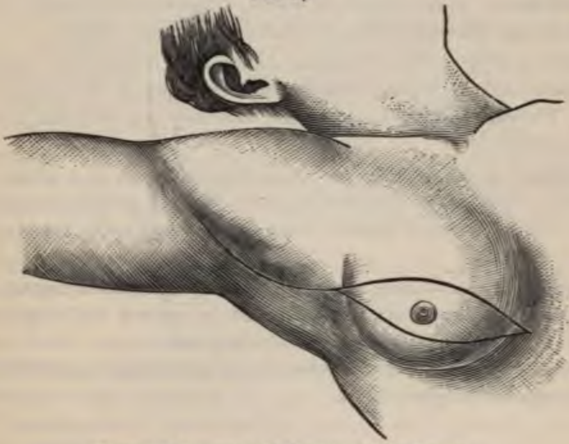
MALIGNANT TUMORS (EMBRYONIC EPITHELIAL TYPE).

CARCINOMA.

Epithelioma; a variety of which is superficial epithelioma or rodent ulcer; *glandular carcinoma;* the varieties of which are spheroidal cells, squamous cells and cylindrical cells.

The epithelial carcinoma, at its outset, grows in the skin or the mucous membrane; the connective tissue undergoes atrophy, and the epithelial cells grow down into the fibrous structure of the skin, and finally involve the underlying structure.

FIG. 24.



Esmarch's Operation for Excision of the Breast.

The glandular varieties of carcinoma are—

1. **Medullary or encephaloid carcinoma**; so called on account of its resemblance to the encephalon of the fœtus.

2. **Scirrhus,** which is the hard variety; of this there is a division known as atrophying or withering scirrhous carcinoma.

3. **The Colloid,** which is a form of scirrhus in which the cells and a portion of the stroma have been converted into colloid material, looking like glue or jelly.

CYSTS.

A cyst is a fibrous membrane forming a sack which incloses a more or less liquid contents.

As a rule cysts are not of new formation.

Cysts are generally formed by the fusion of the lymph spaces of a tissue, by the obstruction of an excretory duct, the softening of a tumor, or the extravasation of blood into a sack. Cysts are sometimes congenital.

They vary in size, from a very small pea to a tumor weighing many pounds.

Dermoid Cysts.—These are always of congenital origin, and due to the invagination of epithelial structure. They are usually found about the orbit, ovary or testicle. They are lined by a wall of true skin, and contain hair follicles, sweat and sebaceous glands, and hair and sebaceous matter.

Retention Cysts. –The formation of these cysts is due to the occlusion of an excretory duct of a gland, together with retention of the contents of the gland. The most common forms are the sebaceous cyst, milk cyst, ranula and encysted hydrocele.

Exudation Cysts.—These are accumulations of fluid in a cavity not provided with a duct, as in hydrocele, housemaid's knee, ganglia formed in connection with the sheath of tendons about the wrist and ankle, the ovarian cyst and cystic goitre.

Softening Cysts.—These are due to the fatty and mucoid degeneration of the elements of a neoplasm; they are called *cystoid*, and are most frequently met with in sarcoma and chondroma of the long bones.

A cyst may be single or multilocular, or it may be simple or proliferous.

Hydroma are neoplastic cysts.

TREATMENT OF TUMORS.

Treatment of Benign Tumors.—A benign tumor that does not give rise to pain, that is of slow growth, that does not threaten life, and does not interfere with the health and strength of the patient, should be let alone. It should, however, be watched, and if it should grow or give trouble it should be removed by the knife; innocent tumors of the mammary glands are exceptions to the rule. They should always be promptly extirpated, as they are liable to change their type and become malignant.

The ligature instead of the knife is generally resorted to in vascular tumors. The écraseur is usually employed in cases of polypoid tumors of the uterus and rectum. Caustics should only be resorted to for the removal of birth-marks of children.

Cysts are most frequently treated by the use of such irritating injections as carbolic acid and tincture of iodine. In the treatment of some cysts the fluid is simply drawn off and a drainage tube inserted. Where the wall of the cyst has undergone great modification, the cyst is to be laid open and then treated antiseptically.

Treatment of Malignant Tumors.—In cases of sarcoma of the long bones amputation of the limb is the rule.

In sarcoma of the soft structures involving the limbs an exploratory incision should first be made down to the seat of disease, and if it be found that it cannot be entirely removed, amputation should be performed well above the site of the disease.

In carcinoma the diseased part should be removed as soon as possible, and the incisions should extend well beyond the apparent limit of the tumor. When the disease affects the mammary glands, not only must the breast be removed, but the axilla must be opened and search made for any infected gland, which should be extirpated. It is frequently impossible to feel small glands through the skin, therefore the axillary space should always be opened and thoroughly examined; the glands will be found affected in nine cases out of ten. At the outset carcinoma is a local disease and therefore should be operated upon early. If there is no recurrence after three years, the patient may be considered permanently cured.

The glands that are immediately connected in the anatomical relations to the seat of disease in carcinoma are found to be involved in the proportion of ninety-five out of one hundred cases; and in sarcoma in about one case in fifty.

Caustics should only be used where the knife cannot be employed, and in cases, such as lupus and rodent cancer, in which it is desirable to remove a very thin layer of the surface, or the portion of the edge of an ulcer; acid nitrate of mercury, arsenic, and chloride of zinc are those generally employed. Arsenic is generally employed in the form of a mixture composed of fifteen grains of white arsenic, seventy-five of cinnabar and thirty-five of burnt sponge, made into a thick paste by the addition of a little water. Chloride of zinc is made into a paste by the addition of three or four parts of flour and a few drops of water.

The following Table is appended to enable the student to more firmly fix in his memory the different varieties of tumors, their types and formations:—

TABLE.

GIVING THE DIFFERENT VARIETIES OF TUMORS; THEIR TYPES AND FORMATIONS.

FROM WHAT DERIVED.	TISSUE FORMED.	TYPE.	BENIGN.	MALIGNANT.
Epiblast.	Skin and appendages.	Epithelial.	Adenoma. Papilloma. Horn. Corn. Wart.	*Carcinoma:—* Epithelioma. Superficial epithelioma or rodent ulcer. Encephaloid. Colloid. Scirrhus. Atrophying scirrhus.
Hypoblast.	Mucous membrane and appendages.	Epithelial.	Adenoma. Papilloma. Villous growth.	Carcinoma.
Mesoblast.	Skin. Fat. Connective tissue. Bones. Cartilage. Blood-vessels. Lymphatic tissue. Nerves. Muscles.	Mature connective tissue.	Lipoma. Fibroma. Osteoma. Chondroma.	*Sarcoma:—* Glioma, or neuroglioma. Spindle-cell. Small round-cell. Large round-cell. Giant-cell.
		High class of connective tissue.	Angeioma. Lymphoma (fibrous). Lymphangeioma. Neuroma. Myoma.	A pigment sarcoma is called melanotic. Giant-cell is called myeloid. The spindle- and small round-cell sarcoma is called medullary. Lymphoma (soft variety), Hodgkin's disease.
		The malignant tumors of the group belong to the embryonic-tissue form.		Myxoma. *Mixed tumors:—* Chondro-sarcoma. Osteo-sarcoma. Myo-sarcoma. Lympho-sarcoma. Fibro-sarcoma.

ANEURISM.

Aneurism is a pulsating tumor, containing blood, and communicating with the interior of an artery.

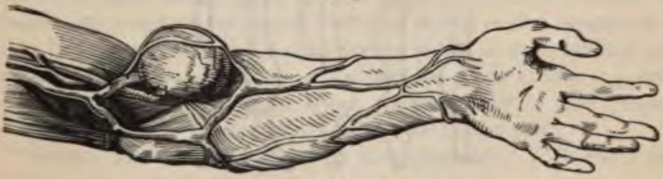
An aneurism consists of a sack formed by one or more of the arterial tunics.

There are two varieties: the *sacculated*, which is formed into pouches, and the *dissecting*, in which the blood finds its way between the arterial tunics.

Aneurism usually commences by a giving way of the internal and middle coats of the artery, at the site of some softened spot, after which the pressure of the blood dilates the external or cellular coat into a pouch. It may commence by the dilatation of all three of the tunics.

It gradually dilates under constant pressure of the heart's impulse, becomes lined with coagula deposited in distinct laminæ.

FIG. 25.



Varicose Aneurism.

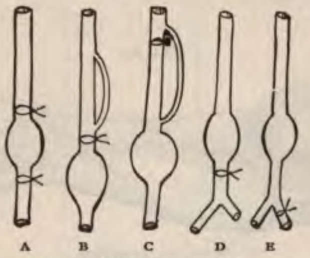
Symptoms.—If it is an external aneurism it may be recognized by the following symptoms: At first there is a small tumor, pulsating strongly, and if the finger is applied to the artery between the aneurism and the heart, the aneurismal sack will be readily emptied by pressure; in the second stage, the blood is beginning to coagulate in the interior of the sack, the coats, at the same time, having become thickened. If the artery is now pressed upon, the sack will be emptied in part, and the swelling will be reproduced when the pressure is abandoned. There is some degree of pain and the circulation is retarded, in consequence of the pressure.

When the aneurism reaches the third stage, it has acquired considerable magnitude, and the pulsation is, in a degree, lost; a small portion of the blood still remains fluid, but the greater part is filled with coagulum.

In internal aneurism the symptoms vary, according to the seat in which the disease is found; the digestive organs will be at fault at one time, the urinary at another, and so on, depending on the part upon which the aneurismal tumor presses.

Diagnosis.—Other tumors situated over arteries may be distinguished from aneurism, by observing that they do not pulsate at first, when they are small, whereas aneurisms do so from their earliest formation; that a tumor may often be lifted up from the artery, and that then it will cease to pulsate; that aneurisms are generally soft at first and become hard afterward; tumors are generally the reverse; tumors cannot be emptied by pressure, and no alteration is made in their size or consistency by compressing the artery above. The pulsation of an aneurism is expansile. In nearly all cases a *bruit* is heard on placing the ear over the tumor; it varies in different cases; it is blowing in its character, is not increased on pressure, and is heard equally well over the whole tumor.

FIG. 26.



DIFFERENT POSITIONS OF LIGATURE OF ANEURISM. (*Walsham.*)
A. Antyllus's method; B. Anel's; C. Hunter's; D. Brasdor's; and E. Wardrop's.

The predisposing cause of aneurism is some preëxisting degeneration of the arteries, which may be preceded by habitual overstrain. Sir A. Cooper speaks of a case where there were seven aneurismal tumors in different parts of the body.

Treatment by Compression.—It is applied upon some part of the affected artery between the aneurism and the heart, and in such a way as to retard the circulation and so cause deposits of laminated fibrin. *Carte's* circular tourniquet is used for the purpose; also Gibbon's modification of Charriere's compressor, or Hoey's clamp.

In some cases a five-pound bag of shot, or an ordinary four-pound weight may be placed over the artery, with a pad intervening, or "*digital compression*" may be used; kept up by relays of assistants, the patient, if necessary, being kept under the influence of chloroform or morphia.

The advantages of compression are, that it can be discontinued at once, if need be; secondary hemorrhage, the frequent accident of the ligature, is obviated; and even if it fails the knife can still be resorted to.

Compression is contraindicted when the integuments are inflamed, or the limbs much swollen, from venous obstruction, and also in cases which are very rapidly increasing.

The pressure should not be severe enough to cause great pain, and if there is room, it should be applied at two or three points in the course of the artery; and not carried to the point of completely closing the vessel. If very restless, the patient may be gently chloroformed, or kept quiet by morphia for two or three hours at a time.

By Ligature.—When compression is inapplicable or unavailing, the artery must be secured between the aneurism and the heart by **1. The Hunterian Method.** The place of election must be neither too near the aneurism, so as to tie a portion of the vessel that is diseased, nor too far from it, lest the circulation through it be kept up too freely by means of collateral branches. The direction and extent of the incision obviously depend on the situation of the artery to be operated on. A healthy portion of the artery is selected, great care is taken, in exposing the vessel, to disturb the sheath as little as possible; two ligatures are used; they are drawn sufficiently tight to gently approximate the inner tunic; the stay knot is tied and the end cut short.

The other methods in vogue are: 2. Anel's operation; 3. Brasdor's distal ligature; and 4. Wardrop's operation.

2. **Anel's operation** is to apply a ligature to the affected artery close above the aneurism. The objections to this method are that the operation is performed on a part of the vessel that is already diseased, and that the proximity of the wound to the aneurism is liable to excite inflammation in and around the sac.

3. **Brasdor's distal ligature** is applied to the diseased artery beyond the aneurism, on the distal side. It is resorted to in aneurism of the carotid, innominate or subclavian artery, when the ligature cannot be employed between the aneurism and the heart.

4. **Wardrop's operation** consists in tying one or more branches coming off beyond the aneurism. It is a modification of Brasdor's operation.

In separating the artery from its accompanying veins, the greatest care must be taken not to inflict injury upon the vessels.

ABDOMINAL SURGERY.

WOUNDS OF THE ABDOMEN.

Wounds of the walls of the abdomen may be caused by fragments of shell, and large portions of the integuments and muscles may be carried away; bullets and swords will frequently traverse the walls of the abdomen without penetrating, and missiles may strike the abdomen and inflict severe injury on the viscera without external injury.

Penetrating wounds of the abdomen, with or without injury to the viscera or large vessels, are followed by great mortality. If the contents of the abdomen are not injured, the chief danger is from peritonitis. When the viscera are wounded, the severity of the danger, in a great measure, depends upon whether a solid organ, such as the liver, spleen, or kidney, has been injured, or if the stomach or intestines have been perforated.

Wounds of the liver, spleen, and kidney are more fatal than those of the stomach and large intestines, and these latter more so than the small intestines.

Symptoms.—Great collapse is the first striking symptom; it is very severe if the viscera have been wounded; and is a common cause of death. Frequent vomiting is a symptom common in wounds of the intestines, particularly if the injury be high in the canal. The pain is great; and blood passed from the bowels is a usual symptom.

The after symptoms are those of peritonitis and such as are referable to the particular organ wounded, *e. g.*, blood with the urine, if the kidney be injured; or bile, if the liver, etc., etc.

Diagnosis.—As an infallible test of injury of the gastro-intestinal canal, in penetrating wounds of the abdomen, the rectal insufflation of hydrogen gas, as originally advocated by Professor Senn, is recommended.

Treatment.—When the cavity of the abdomen is penetrated, place the patient on a bed, carefully examine the wound, and return any viscera that may protrude. If the intestine be wounded, stitches must be applied. Preference is given to Lembert's interrupted suture; see page 59, article "Sutures."

To relieve pain and to arrest peristaltic action, large and repeated doses of opium are called for.

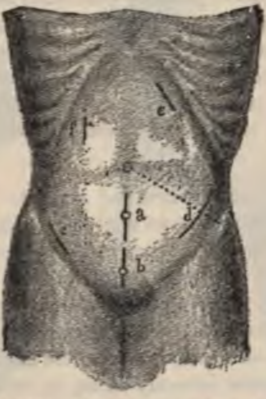
Where there is only a superficial wound, endeavor to procure union by means of sutures.

Laparotomy or **Abdominal Section** is performed either for the removal of foreign bodies from the intestines, or when acute obstruction exists, in cases of intussusception, or of injuries of the abdominal viscera.

If the weather be cold, the temperature of the apartment, prior to commencing the operation, should be raised to about 70° F. Then the patient having been placed upon his back, his bladder should be emptied, and chloroform administered. He is then brought to the edge of the bed with his legs hanging over it. Flannels wrung out of warm bichloride solution (1–2000), or flat sponges wrung out of warm carbolized water, should be at hand, ready for use; and the strictest antiseptic precautions observed throughout the operation.

The surgeon makes an incision in the middle line below the umbilicus, or over the seat of obstruction if it can be determined, and carries his knife cautiously down to the peritoneum; this membrane is then carefully scraped through at one spot, the finger passed in, and the peritoneum split up by a probe-pointed bistoury, guarded by the forefinger beneath.

FIG. 27.



LINES OF INCISION OF CERTAIN OPERATIONS ON THE ABDOMEN. (*Walsham.*)
a, Laparotomy, ovariotomy; *b*, Suprapubic cystotomy; *c*, Ligature of external iliac artery; *d*, Inguinal Colotomy; *e*, Gastrostomy; *f*, Cholecystotomy.

Protruding coils of intestine are to be gently drawn aside by an assistant, using the wet flannels or carbolized sponges for the purpose, while the operator searches carefully *upward* along the empty coils of the bowel until he arrives at the *source of obstruction*. If an *intussusception* exist it must be reduced.

The intestines are then replaced, the peritoneum cleansed with aseptic sponges, and the wound closed in the usual manner.

If the bowel cannot be released, it may be opened as low down as possible, and the aperture stitched to the integument of the abdominal wound, and an artificial anus established.

The after-treatment is that of an abdominal wound with peritonitis.

Professor Senn's method of employing Intestinal Anastomosis and Enterectomy may be beneficially adopted in many cases. See Senn on Intestinal Surgery.

Appendicitis is an inflammation of the vermiform appendix. Pain, swelling, and tenderness usually exist in the right iliac region; the most sensitive spot is that known as McBurney's point, which is situated at the centre of a line drawn from the anterior superior spine of the ilium to the umbilicus. Fluctuation may or may not be present; even when there is a large accumulation of pus, fluctuation is frequently absent. Vomiting with obstinate constipation are usual symptoms. There is always a rise of temperature.

It may be assumed with certainty that an abscess has ruptured in the abdominal cavity, if the pulse become small and wiry, the temperature below the normal, or extremely high, the pain diffused, with accompanying symptoms of profound shock.

Treatment is divided into medical and surgical. In the incipiency of the attack salines should be administered until free evacuations are produced; the patient should be kept in perfect rest and fed on spoon diet. The applications of hot fomentations and turpentine stupes are very beneficial. If there be much nausea or vomiting, morphia may be administered hypodermatically. As soon as the intestinal canal has been thoroughly emptied opium should be administered to relieve pain and secure rest to the inflamed parts.

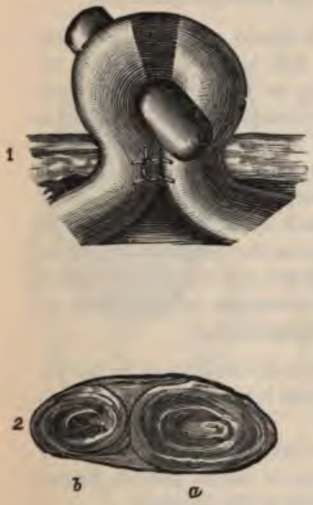
An operation may become necessary during an acute attack of the disease, when an abscess has formed, or when a perforation has taken place. If it be possible, it is better to operate during the intervals, when the patient is comparatively comfortable.

The patient is prepared antiseptically; an incision is made along the outer border of the rectus muscle, from the level of the umbilicus to near the middle of Poupart's ligament. The abdominal cavity is opened in the usual manner and the appendix sought for; when found a stout silk ligature is thrown around it and firmly tied. It is then cut off as near as practicable to the ligature. The stump is disinfected by the application of the actual cautery or carbolic acid. The cavity is then thoroughly flushed with warm distilled water, a drainage tube inserted and the wound closed and dressed in the usual manner.

If the inflammation has resulted in a circumscribed abscess, the incision should be made from the middle of Poupart's ligament toward the anterior superior spine of the ilium; it should be from four to six inches in length. The operation is then proceeded with in the manner just described.

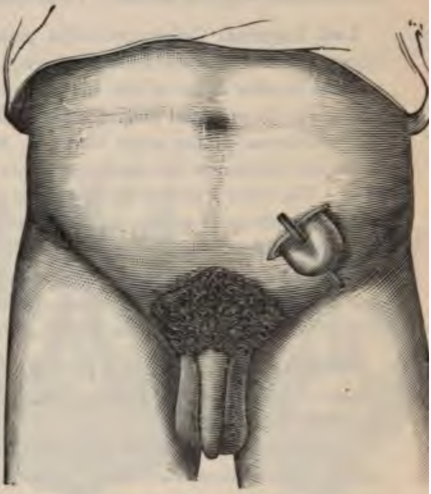
Colotomy.—This operation is performed where there is an invagination of the intestine, where the operation for anastomosis or resection is not practicable, and where stricture of the rectum may render it advisable.

FIG. 28.



1. The Intestinal Loop drawn forward.
2. Completely severed.
(*a*) Conveying; (*b*) Discharging End.

FIG. 29.



First Stage of Maydl's Operation for Artificial Anus.
(*After Esmarch.*)

The operation is resorted to in order to establish either a temporary or a permanent fistula. It may be undertaken in either the inguinal or lumbar region.

Lumbar colotomy may be effected either in the right or left loin; the latter being the most common. The mode of performing the operation is practically the same on either side: the patient is prepared in the usual manner; placed upon the side of the body opposite to that to be operated upon; the flanks are to be well supported by means of a sand-bag or hard pillow; an incision is made extending from the edge of the erector spinæ just below the border of the last rib and carried down toward the anterior superior spine; the structures are cut through until the transversalis fascia is reached, which is to be carefully divided; the fat which lies over the colon separated, and the gut stitched to the skin. If the symptoms are not urgent the bowel should not be opened until the third day after the operation, so that the parts may have an opportunity to become adherent; if, however, it is necessary to make the opening without delay, fasten it to the skin, protect the parts with gauze pads so that no fecal matter can extravasate into the surrounding tissue, stitch the bowel at the point of opening to the skin and close the upper and lower angle of the wound with silk sutures. Dress with a large antiseptic gauze pad.

Left Inguinal Colotomy.—The patient is placed upon his back; the operator makes an incision, commencing one inch to the inner side of the anterior superior spine of the ilium, terminating an inch above and a little external to the centre of Poupart's ligament; the structures are divided down to the peritoneum in the usual manner. Arrest all hemorrhage and carefully incise the peritoneum for the length of an inch and a half, and stitch it to the skin. The colon is now to be fastened to the margin of the wound by means of a row of interrupted sutures an eighth of an inch apart; if feasible, wait for three days before opening the bowel. If, however, the symptoms are urgent, proceed with the operation, taking the greatest care not to infect the wound, and at the same time see that the parts are thoroughly irrigated with an antiseptic solution. Dress the wound with an antiseptic pad.

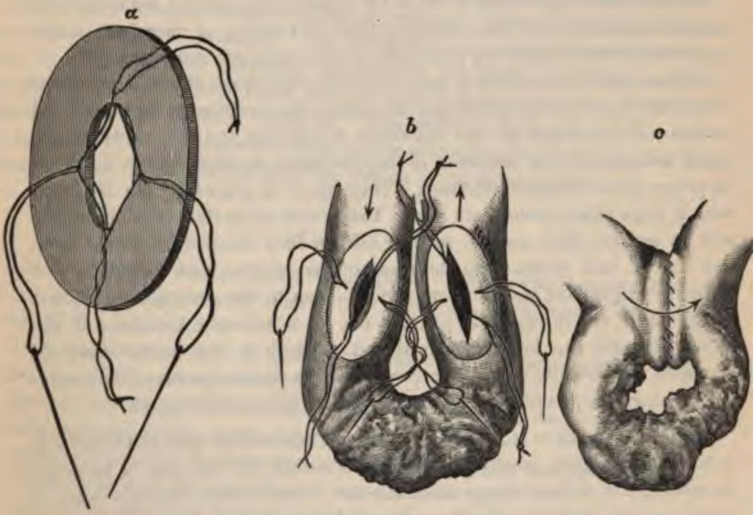
Intestinal Anastomosis is performed in cases of obstruction of the bowels Its object is to establish a communication above and below the point of obstruction in the intestines.

The portions of gut to be approximated are held in position by means of plates made of decalcified bone, leather, or rings of various patterns devised by Abbé, Brockaw, and Matis; or the metal button of Dr. Murphy.

The parts of the bowel between which it is desired to establish a communication are brought into the wound and separated from the rest of the intestines by means of sterilized gauze pads; a slit is made in the mesentery above and below the part to be united, and a piece of gauze is passed through this opening and tied over the gut so that no extravasation from the bowel can take place; an incision is made, the length of the greatest diameter of the ring to be used, on the convex surface of the bowel opposite the attachment of the mesentery. The interior of the bowel is now to be thoroughly irrigated with hot distilled water, and the ring put through the wound in the gut and fastened in place by means of the four sutures attached to it. The wound in the other portion of the bowel is treated in the same manner, and the openings in the gut fastened by tying together the four sutures of each ring or plate; the parts are again washed and a row of continuous sutures is made at the border of the plates, in order to have a broad approximating surface. The gauze tied above and below the rings is now removed, the intestines returned to the abdomen, the wound closed and dressed in the usual manner.

Perfect rest is to be enjoined; if there be nausea, vomiting, or thirst, very hot water, or small pieces of cracked ice should be administered. Only liquid diet should be allowed for two days after the operation. The bowels should not be disturbed for three days, when an enema should be administered; a teaspoonful of sulphate of magnesia should be prescribed until a movement has been produced. If there be much pain, opium in some form is indicated; it should not be employed if its use can be avoided.

FIG. 30.



Bone Plate. Introducing the Bone Plates. Seam.

ENTERO-ANASTOMOSIS. (*Senn.*)

This mode of treatment is to be pursued when the patient is strong enough to stand the operation, and when a more radical procedure is not contraindicated, owing either to the advance of the disease, or to the want of strength of the patiemt.

In performing the operation every effort must be made to economize time and to prevent shock; an assistant should be detailed to keep the intestines warm by means of cloths wrung out of hot water. If there be evidence of shock being developed, a twentieth-grain dose of strychnia, or a sixtieth of a grain of atropia, together with whisky, should be administered.

Nephrorraphy.—Floating or movable kidney may exist on either side, but is most commonly on the right. It occurs usually in individuals who are poorly nourished, especially in women, pregnancy acting as an exciting cause.

As a rule a movable tumor is felt in the hypochondriac region, but it might be located in any portion of the abdomen; there is a feeling of uneasiness, but in some cases there is agonizing pain, with marked dyspeptic symptoms.

In those cases where there is little discomfort the patient should wear a large abdominal supporter and pay proper attention to the condition of the bowels and to diet. If the health of the individual is suffering and the constitution is being undermined, the operation of nephrorraphy, or stitching the kidney in its proper place, becomes necessary. The patient is placed on the abdomen, with a large pillow underneath him. The twelfth rib is then carefully located and an incision made parallel to and half an inch below it; it should begin two and a half inches from the spine of the vertebra, and should be four inches in length; the structures are divided down to the perinephritic fat, care being taken not to open the pleura; the fat is separated by means of dissecting forceps, the kidney exposed and stitched to the lumbar fascia by means of six silk sutures, using a curved needle for the purpose; the sutures are cut short, the wound drained for twenty-four hours, and dressed.

Renal Calculus or stone in the kidney. There will be pain and uneasiness in the lumbar region, usually just below the twelfth rib; the pain is increased on motion, and at times shoots down the cord to the testicle; frequent desire to micturate will exist, occasionally accompanied by blood, varying in quantity; pyuria will also be present.

Nephrotomy.—The kidney should be cut down upon in the same manner as described in the operation for nephrorraphy; when the kidney is reached, the operator takes it between the finger and thumb to feel if a stone be present; should none be detected a long exploring needle is passed into the kidney in several directions; this means failing, an incision is made through the capsule, the kidney divided by means of a dry dissector, and the operator passes his finger into the pelvis of the kidney and searches for the stone. If one be present it is removed by means of a lithotomy forceps or a scoop; the cavity is then flushed with an antiseptic solution, and afterward packed with iodoform gauze, a drainage tube is inserted and the wound dressed in the usual manner.

Nephrectomy.—Removal of the kidney. This operation is performed where wounds, or rupture of the ureter make it necessary, and in cases of malignant tumors, tuberculosis, multiple abscesses, calculus, pyonephrosis, and hydronephrosis.

The kidney may be removed on lines that have already been laid down when describing other operations involving this organ. When the tumor is very large the kidney is more readily reached by an incision made through the linea alba; or it may be made along the outer edge of the rectus muscle. The peritoneum can be readily detached without making an incision. Unless it be too adherent the capsule should be separated. The gland must be removed from its bed of fat; the ureter tied by a separate ligature, and the stump disinfected. The vessels are to be included in an ordinary pedicle ligature, and the structures divided about half an inch therefrom. Hemorrhage is to be controlled in the usual manner; if it becomes necessary, a hæmostatic forceps may be retained in place. Close the wound and dress the patient in the usual manner.

HERNIA.

Hernia is a term used to signify the protrusion of any viscus from its natural cavity, but surgeons generally confine it to protrusions of the viscera from the cavity of the abdomen.

There are many varieties of hernia, depending upon the parts in which they occur, or according to their contents.

Herniæ most frequently make their appearance at the groin, the navel, the labium pudendi, and the upper and fore part of the thigh.

Inguinal hernia is the name when the hernia protrudes at the abdominal ring.

Scrotal hernia, if the parts descend to the scrotum.

Femoral hernia, when it takes place below Poupart's ligament.

Umbilical hernia, when the bowels protrude at the navel.

Ventral hernia, when it occurs at other parts of the abdomen.

Congenital hernia, when the parts have not any proper peritoneal sac, but are contained in the *tunica vaginalis testis*.

From the contents of the hernia, they are said to be either enterocele, epiplocele or entero-epiplocele.

It is *Enterocele*, if a portion of the intestines alone form the contents of the tumor; Epiplocele, if omentum only; Entero-epiplocele, if both intestine and omentum.

Herniæ are said to be —

Reducible, when the protruded bowels admit of being readily returned to the abdomen; *irreducible*, when the protruded bowels suffer no constriction, but cannot be returned to the abdomen, owing to adhesions, or to their large size in relation to the aperture through which they have to pass.

It is *strangulated* when it not only cannot be reduced, but suffers constriction also.

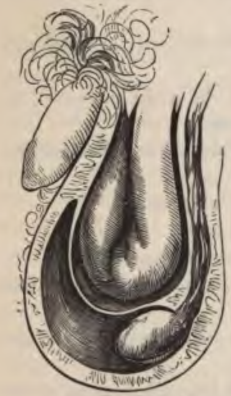
The predisposing causes are deficiencies, or resistance, resulting from relaxation, or malformation; the principal are a preternaturally large size of the openings at which the bowels are likely to protrude; a weakness and relaxation of the margins of these apertures, and a laxity of the peritoneum.

The exciting causes are the powerful action of the abdominal muscles and diaphragm, accidental blows, great muscular action, obesity, wearing tight clothes, pregnancy, jumping, etc., etc.

Symptoms.—*Of reducible hernia* are: a swelling at some point of the abdomen, which is subject to change of size, being smaller when the patient lies on his back, and larger when he stands up and holds his breath. It diminishes when pressed, and grows larger when the pressure is removed. Frequently, in consequence of the unnatural condition of the bowels, patients affected with hernia are troubled with colic, constipation, and vomiting.

If the case be one of intestinal hernia, it will be characterized by the uniformity of its surface; it is generally larger when standing up than when lying down; it presents a distinct impulse on coughing; it is tympanitic on percussion; a gurgling noise is often made when the bowel is ascending.

FIG. 31.



Scrotal Hernia.

If the hernia is *omental*, the tumor is more flabby and has a more unequal feeling; it is generally indolent; it is dull on percussion; the impulse on coughing is fainter; if reduced it returns gradually and without gurgling.

If it is *entero-epiplocele*, the characteristic marks are less clear, being a combination of the symptoms which attend the more simple cases.

The prognosis in reducible hernia is favorable as long as the rupture is of moderate size, can be kept well up by a proper truss, and the patient is not exposed to violent exertion.

Sir Astley Cooper has observed that the danger of hernia is in proportion to the smallness of its size.

A reducible hernia must be returned to the cavity of the abdomen without delay, and as soon as the parts are returned a suitable truss must be put on and worn without intermission.

Irreducible Hernia.—The most frequent causes that prevent the ordinary reduction of hernia are either the largeness of the contents, alteration in its form and texture, adhesion of parts and formation of membranous bands within the sac. If the tumor cannot be returned, and no unpleasant symptoms attend the case, the only thing to be done is to keep the parts in a suspensory bandage, to prevent an increase of the malady, or make use of a truss with a hollowed pad, so as to support and protect the parts; or perform the operation for the radical cure of hernia.

Strangulated Hernia.—The indications of a strangulated hernia are a tumor in the situation of the rupture, attended with pain over the whole abdomen, sickness and inclination to vomit, suppression of stools and some fever. If the reduction be delayed, the vomiting becomes very frequent; all the contents of the stomach, and afterward of the intestines, are rejected. There is great anxiety and restlessness, with cold extremities and a small, quick, and hard pulse. Then hiccough comes on, the pulse is hardly perceptible, respiration weak, and the whole body is covered with a cold, clammy sweat. The protruded viscus now begins to mortify; the patient suddenly becomes easy, the swelling of the belly subsides; the tumor diminishes; the skin sometimes changes to a livid hue; its feeling is emphysematous, and it crepitates on being touched. In this state the gut returns to the abdomen spontaneously, or is readily returned, and the patient fancies himself better. This feeling is, however, of short duration; hiccough and cold sweat increase, convulsive symptoms come on, and the patient soon expires.

The immediate cause of these bad symptoms is the stricture made on the prolapsed part of the gut by the aperture through which it passes; consequently, its removal is the only thing that can bring relief, and this object is to be accomplished by returning the bowel into the abdomen, or dividing the parts which form the stricture.

The remedies generally employed before an operation is resorted to, are the taxis, cold applications, the hot bath, 96°–100° F., a large dose of opium or morphia.

The Taxis.—The bladder having been emptied, the patient should lie down in an attitude of complete repose, and be put under the influence of chloroform; if this is not used, he should be put in a warm bath, both thighs flexed and placed close to each other, so that every muscle and ligament connected with the abdomen may be relaxed; then the surgeon grasps the lower part of the tumor with the palm of one hand, tenderly compresses it, and with the fingers of the other kneads the parts at the neck of the tumor, occasionally drawing them very gently downward, in order, if possible, to dislodge them. If the tumor be not sensitive, this operation may be continued for half an hour, when the gurgling sound which accompanies the return of the intestines may be heard.

If taxis under the influence of chloroform fail, the surgeon should proceed to perform the necessary operation.

Having gone through the general treatment of herniæ in their respective stages, they are now to be spoken of specifically.

There are four varieties of abdominal hernia to be described; viz., *inguinal*, *femoral*, *umblical*, *ventral*.

INGUINAL HERNIA.

There are three kinds of inguinal hernia: the oblique, direct and congenital.

Oblique Inguinal Hernia.—This variety takes the course of the spermatic cord; it begins with the cord as it passes out of the abdomen, and follows the direction of the inguinal canal; its course is oblique, and on this account is so called.

With respect to the parts about the hernial sac; the spermatic cord is behind, the testicle below, the internal oblique and transversalis above, and the fascia transversalis beneath it.

Direct Inguinal Hernia.—In this case the hernia does not follow the course of the spermatic cord, but comes out almost directly through the external abdominal ring, and pushes before it the fascia transversalis. It passes on the *inner side* of the epigastric artery, and directly as it emerges from the ring is received under the fascia of the cord, which forms one covering, and passes into the scrotum.

Direct inguinal hernia may be known from oblique: first, by tracing the spermatic cord, it will be found that the hernia is *behind* the cord, whereas in oblique it is *before* it; secondly, when the mouth of the sac is traced, in oblique hernia, it will be discovered *above* the abdominal ring, toward the spine of the ileum; but in direct hernia, there is an inclination *inward* toward the umbilicus.

CONGENITAL HERNIA.

In this hernia the protruded parts have not any proper peritoneal sac, but are contained in the tunica vaginalis of the testicle, which serves as the hernial sac.

FEMORAL OR CRURAL HERNIA.

The seat of femoral hernia is the upper and fore part of the thigh, the protruded intestine passing out at the same opening through which the large blood-vessels are transmitted to the thigh, and consequently, under Poupart's ligament. It is most frequently met with in women.

The characteristic symptoms of femoral hernia are its situation with respect to inguinal hernia; its capability of reduction with regard to bubo.

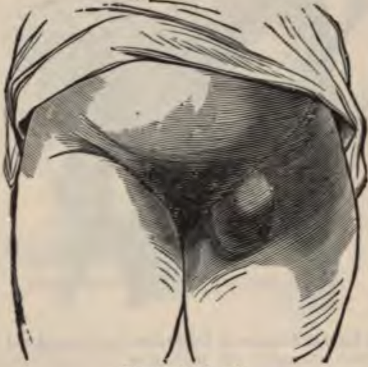
UMBILICAL HERNIA.

In this hernia some of the viscera of the abdomen, more frequently omentum, pass out at the umbilicus, through an opening in the linea alba, and, as in other varieties of hernia, are included in a sac formed by the peritoneum.

VENTRAL HERNIA

differs from umbilical in its seat, which is usually at the linea alba, or linea semilunaris; but any visceral protrusions at the anterior or lateral parts of the abdomen, except those already described, may be called ventral hernia.

FIG. 32.



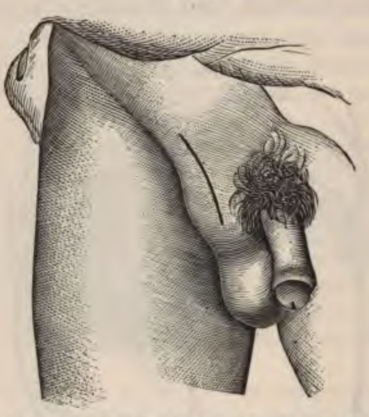
Femoral Hernia.

Operation.—Having used the means for reduction already pointed out, without success, an operation becomes necessary; taking care not to delay too long.

While the anæsthetic is being administered, the skin about the hernia must be shaved and the parts thoroughly cleaned. The whole proceeding to be carried out as described under the head "Antiseptic Surgery," page 52. The incision varies according to the site of the rupture.

Oblique Inguinal Hernia.—The patient should be placed upon a table, with legs hanging over; remove the hair; commence the incision from the upper part of the tumor, and carry it along the middle to the lower part. By the first incision the fascia of the cord is laid bare, and in doing this the external pudendal artery, which crosses directly opposite the abdominal ring, is divided; this must be secured; then scratch through the fascia of the cord just below the ring, introduce a director upward to the abdominal ring and inferiorly to the lower part of the swelling, and divide the fascia. The fibres of the cremaster are then brought n view; this covering is somewhat dense and must be opened with care; a director is introduced under it, as far as the fascia of the cord, and it is then divided; when this is done, the hernial sac is exposed; it is of a bluish appearance and semi-transparent, from the fluid it contains. Having laid bare the sac, pinch it and feel distinctly the intestine and omentum within. Raise the sac, to separate it from its contents, and make a small cut into it, in a lateral direction; place the instrument horizontally, to avoid the danger of wounding the intestine. As a rule, if the intestine be included in the sac, fluid escapes as soon as an opening is made. Having opened the sac, a director is to be introduced as far as the abdominal ring, which is then divided; the director is then to be carried into the lower part of the sac, in

FIG. 33.



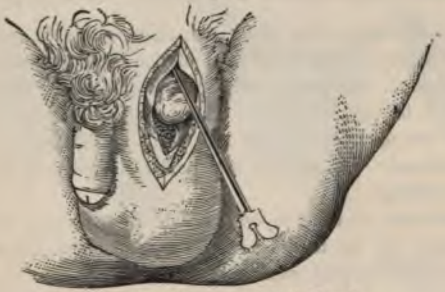
Showing Line of Incision in Operation for Strangulated Hernia.

the same manner. When both omentum and intestine are in the sac, the omentum will be found before, and the intestine behind.

After having opened the sac, next feel for the stricture; put the little finger in the hernial sac, and ascertain if the stricture is situated at the abdominal ring, and then pass a probe-pointed bistoury, guided on the finger, and divide the stricture, not freely, but to a small extent; a slight motion of the knife will do.

The stricture does not generally exist at the external ring; it is usually situated at the upper part of the hernia, opposite the tendon of the transversalis muscle, or in the sac itself. When this is the case, slit up the abdominal ring, hook up the abdominal muscles and draw them upward toward the abdomen, then pull down the hernial sac; the stricture is thus exposed. Then divide the stricture in the centre and *cut directly upward*, let the hernia be where it may, and the danger of wounding the epigastric artery will be avoided. The intestine should be returned piecemeal to the cavity of the abdomen, and then the omentum will follow it.

FIG 34.



Operation for Oblique Inguinal Hernia.

Direct Inguinal Hernia.—In operating on these cases it must be borne in mind that the spermatic cord is placed on the other side; that the hernia is covered by the fascia of the cord, by the cremaster partially, and is contained in a sac, formed by the tendon of the transversalis muscle, assisted by the fascia transversalis, besides a peritoneal sac. The division of the stricture must, therefore, be *directly upward*.

Congenital Hernia.—*The seat of stricture* will be usually found under the edge of the transversalis muscle, or at the internal ring, when it should be divided in the same manner as in other cases of hernia.

Femoral Hernia.—The first incision is made in the course of Poupart's ligament, along the tumor, extending from one side to the other; the second cut is made at right angles to the first, toward the umbilicus, so that the two incisions resemble the letter T inverted. The flaps are then dissected off and reflected. This exposes the superficial fascia, which is next divided, and the *fascia propria* is then brought into view; cut through this and the peritoneal covering presents itself. Then make an incision, with the greatest care, and introduce a director, to ascertain the seat of stricture. Having opened the hernial sack and exposed the intestine, divide the stricture directly *upward and inward*, a little inclined to the umbilicus. The seat of stricture is at the posterior edge of the crural arch, just where the intestine leaves the abdomen; therefore, in dividing the stricture, after introducing the director, a bistoury, blunted at the point, is to be put on it and placed against the stricture; in this way there is no danger of wounding the intestine. The bistoury is next gently raised, and, with a slight touch of the instrument, the fibres give way.

Umbilical Hernia.—First make an incision across the tumor and then another at right angles, so that it will resemble the letter T inverted. The integument being divided, the corners of the incision are to be turned aside, by which the sack will be brought into view. This being carefully opened, the finger is to be passed into the orifice of the sack at the umbilicus and a blunt-pointed bistoury introduced. The stricture is to be divided *upward*, in the direction of the ensiform cartilage.

As a general rule, after having operated for the relief of a strangulated hernia and returned the gut to the cavity of the abdomen, the operation for the *radical cure* should be performed.

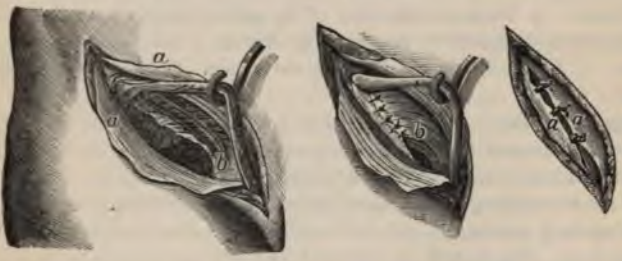
Treatment after the Operation.—The patient should be kept in the recumbent position with his knees flexed over a pillow. As soon as he has recovered from the effects of the anæsthetic, a hypodermic injection of morphia should be given. No food should be allowed for at least thirty-six hours. A little ice may be given to relieve thirst, and if there be much prostration the strength may be supported by enemata of beef tea, with a small quantity of brandy. If there is abdominal pain, give morphia. Keep the bowels quiet until the seventh day; if they have not spontaneously acted by that time, and all the symptoms are favorable, administer an enema. The drainage tube may be removed at the end of forty-eight hours, and the sutures should be taken out between the sixth and eighth day.

Generally the antiseptic dressings may be discontinued on the tenth day, and the wound then treated with iodoform or boracic acid. The patient should be kept in bed for at least three weeks, and at the end of a month, if required, a truss may be applied. The patient must not rise without a truss or a properly applied pad or bandage.

RADICAL CURE OF OBLIQUE INGUINAL HERNIA.

The Basini Method.—Expose the sack in the usual manner. Return the intestine to the abdominal cavity. Carefully separate the spermatic cord from the sack; twist the sack; apply around its neck a stout ligature, and excise all the part in front of the ligature. The spermatic cord is then to be lifted up and the border of the rectus and edge of the internal oblique muscles joined together by suture; the transversalis muscle and fascia are stitched to Poupart's ligament under the cord. The cord itself is placed on this layer of sutures, and the lower border of the external oblique is affixed by suture to Poupart's ligament over the cord, which makes for it a new canal. The skin is then brought together in the usual manner. After convalescence is established the patient should wear a truss for at least six months, by which time the cicatricial tissue will become firm.

FIG. 35. FIG. 36. FIG. 37.



RADICAL OPERATION FOR INGUINAL HERNIA. (*Bassini.*)

The Pillars open, the Cord held up. The Pillars sutured, the Cord held up. The Deep Fascia closed over the Cord.

For the various methods of operating for the radical cure of other varieties of hernia, the reader is referred to the larger text-books on Surgery.

DISLOCATIONS.

A dislocation is the removal of the articulating portion of a bone from that surface to which it is naturally connected.

Symptoms characteristic of dislocation are: An alteration in the form of the joint; an abnormal prominence at one part, and depression at another, with lengthening or shortening; loss of proper motion, and alteration in the axis of the limb, together with pain, numbness, and absence of crepitation.

Before completing the diagnosis the injured should always be compared with the sound joint, and the difference carefully noted.

Causes.—1. The ball and socket joints are most liable to dislocation, from their wide range of movement. 1. Age: Dislocations are more frequent in middle age. 3. Sex: Males are more frequently subjects of this form of injury than females. 4. Previous dislocation of the affected joint. 5. Alteration of the articulation, the result of disease, as the fracture or ulceration of a process of bone. 6. External violence. 7. Muscular action. 8. Elongation of ligaments.

Diagnosis.—Dislocation is distinguished from fracture by the absence of crepitus; a dislocated limb is less easily moved than the joint in its natural state; the fractured bone is more freely moved. If a fractured bone is drawn into its normal position, it will resume its distorted shape when the extension is discontinued; if a dislocated bone is drawn into its natural position, it usually remains there. The limb of the fractured bone will most generally be found shortened.

Morbid Anatomy.—Dislocation is attended with rupture of the ligaments and muscles in the neighborhood of the joint. Bones, too, may be fractured and cartilages injured. The ligaments, as a rule, reunite and heal. If the dislocation be not reduced lymph is thrown out around the head of the bone and a new socket is formed, the ligaments becoming lined with a smooth, ivory-like substance, and frequently a degree of motion is acquired. The old socket is gradually filled up. The great vessels sometimes become adherent to the capsule or periosteum of the displaced bones, and fatal hemorrhage may result if attempts are made at reduction.

Treatment.—Dislocations should always be reduced as soon after the accident as possible. Whenever practicable the patient must be put under the influence of chloroform, so as to prevent the involuntary resistance of muscles.

The reduction of a dislocation is effected by getting the head of the displaced bone in such a position that the muscles will draw it into its socket; this may be done by *manipulation* and *manœuvring*, and by such movements of flexion, extension and counter-extension, as will bring the bone back into its normal position. Direct force may be used. Extension should be made in such a manner as to relax as many of the opposing muscles as possible; this should be aided by such gentle rotation, extension and counter-extension, as may assist in dislodging the dislocated bone. After reduction, leeches, fomentations, and ice to the part, together with purging, may be necessary, to prevent inflammation, and to give the ligaments an opportunity to heal; the joint should be kept at rest for some time.

The different methods of extension and counter-extension, with the necessary apparatus and appliances to be used will be described when treating of particular dislocations.

COMPOUND DISLOCATIONS.

A compound dislocation is one in which there is a wound communicating with the injured joint; it is usually accompanied by severe contusion and laceration of the surrounding textures.

Compound dislocations occur most frequently in the ankle joint; next in the knee and elbow joint.

Compound dislocations are very severe forms of injury, attended with much danger, and are apt to be followed by hemorrhage, acute synovial inflammation, rapid ulceration of the cartilage, abscesses, pyæmia, erysipelas, tetanus, etc.

Inflammation is apt to supervene, which will be followed by suppuration, frequently profuse, often terminating in sloughing and gangrene.

Treatment.—Having reduced the dislocation, wash the parts thoroughly, so as to remove all foreign bodies; apply a suitable bandage or apparatus to prevent a recurrence of the dislocation; then close the wound so as to procure union by adhesion, if possible. The first attempt should be to convert the compound into a simple dislocation.

If union by adhesion is impossible and the dislocation cannot be converted into a simple one, and if suppuration ensue, the joint must be opened and washed out daily with an antiseptic solution and thoroughly drained. Complete rest must be enjoined. Should diffuse accumulation of pus supervene, early, free and dependent incisions must be made. The dry dressing must be used.

The joint must be thoroughly washed out with 1–1000 bichloride solution. The skin surrounding the wound must be washed well with the same lotion, a large gauze dressing applied. If the patient is not seen until from twenty-four to forty-eight hours after the accident, chloride of zinc (gr. xj to ℥j), or iodoform in alcohol and water are to be employed.

The *general treatment* consequent upon prolonged suppurative discharge should be sustaining and stimulating, consisting of animal food, with wine, beer, spirits, etc. Tonics, such as quinine, dilute nitro-muriatic acid; and sleep must be procured by opiates.

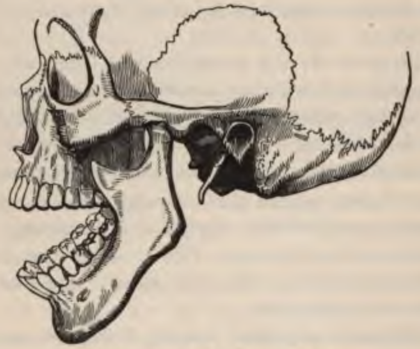
DISLOCATION OF THE LOWER JAW.

A blow on the chin when the mouth is widely opened will cause this dislocation. Yawning will also produce it.

Symptoms.—Both condyles are advanced between the surface of the temporal bone and zygomatic arch; the mouth is open, and the patient is not able to shut it by pressure made on the chin; the lower teeth are on a line anterior to the upper; the appearance is that of a person yawning; the pain is severe; the saliva is increased and dribbles from the mouth.

If the lower jaw is partially dislocated one condyloid process only advances, while the other remains in the articular cavity.

Fig. 38.



Dislocation of the Lower Jaw.

Reduction.—If recent, this dislocation is reduced by wrapping a handkerchief around the thumbs, placing them on the coronoid processes, and depressing the jaw, force it backward as well as downward, and the bone suddenly slips into its place. If this does not answer, the following method is to be tried: The patient being seated, his head supported by an assistant, the surgeon, standing in front, introduces his thumbs into the mouth, as far back as possible upon the molars, and places the fingers of each hand under the chin and base of the jaw. Using his thumbs as fulcrums, the back part of the jaw is forcibly depressed, to disengage the condyles from the zygomatic fossæ, and at the same moment the chin is elevated by the surgeon's fingers. The thumbs of the operator are to be thoroughly protected by the folds of a handkerchief or napkin. If the dislocation has existed some time, the better plan is to place some yielding substance, like cork, behind the molar teeth, on each side of the mouth, and then raise the chin over them.

DISLOCATIONS OF THE CLAVICLE.

The sternal end of this bone may be dislocated forward, and also backward; more frequently forward, when it is thrown upon the upper part of the sternum.

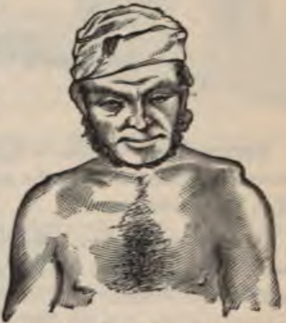
When the dislocation is in front of the sternum, the reduction is easily effected; place your knee against the spine, draw the shoulders backward, and the clavicle will assume its natural position; then apply the clavicle bandage, placing a pad on the displaced end of the bone.

The dislocation behind the sternum is a very rare occurrence; it may be produced by curvature of the spine; if so, there is no mode of reducing it.

The *outer extremity* of the clavicle is most frequently dislocated upward on the acromion; it is, more correctly speaking, a dislocation of the acromion from the clavicle, where the bone is thrown upon the *upper surface* of the acromion, or upon the *anterior part of the spine of the scapulæ*. It is usually caused by violent falls upon the shoulder.

Symptoms.—There is a distinct prominence, formed by the displaced bone, upon the surface of the acromion, which disappears on raising the arm; the limb hangs closely along the trunk, the shoulder is somewhat flattened. The facility of reduction, and the prominence of the clavicular portion of the trapezius muscle, indicate the nature of the accident.

FIG. 39.



Dislocation of the Acromial end of the Clavicle.

Treatment.—Reduction is effected by raising the shoulder, drawing it backward and carrying it outward by placing a pad in the axilla and bringing the elbow well to the side. After reduction, the treatment is the same as for fracture of the clavicle. A thick pad, with the base directed upward, is placed in the axilla, and the arm and forearm must be well secured to the chest; direct pressure must be made by means of a pad and gutta-percha plate laid on the projecting clavicle, and strapped tightly down by a band passing parallel to the arm and under the flexed forearm. This is retained in position by being attached to a strap passed around the opposite axilla.

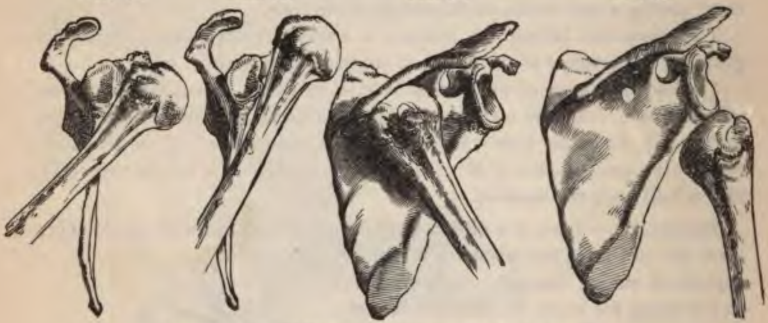
DISLOCATIONS OF THE HUMERUS.

First Dislocation.—*Downward* into the axilla, which is most common.

Symptoms.—The arm is lengthened; a hollow is felt under the acromion; the shoulder is flattened externally; the elbow sticks out from the side and cannot be made to touch the ribs; the head can be felt in the axilla.

Second Dislocation.—*Forward* beneath the clavicle, upon the second rib, the coracoid process being on the outer side.

FIG. 40. FIG. 41. FIG. 42. FIG. 43.



Figures Showing Various Dislocations of the Humerus.

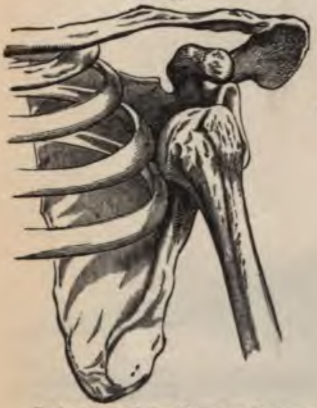
Symptoms.—The arm is slightly shortened; elbow projects backward; the acromion seems pointed; the depression of the deltoid is more considerable than in preceding case.

Third Dislocation.—*Backward* on dorsum scapulæ, beneath the spine, where the head of the bone is readily felt and follows the movement of the elbow when located.

Fourth Dislocation.—Is partial; the bone thrown forward against the coracoid process; the *symptoms* are projections of the acromion and a hollow under it, while the head of the bone is prominent in front and may be felt to move on rotating the elbow. If the hand of the injured side is placed upon the sound shoulder, the patient will be unable to bring his elbow to his side, and if the elbow is brought to the side, his hand cannot remain on the shoulder.

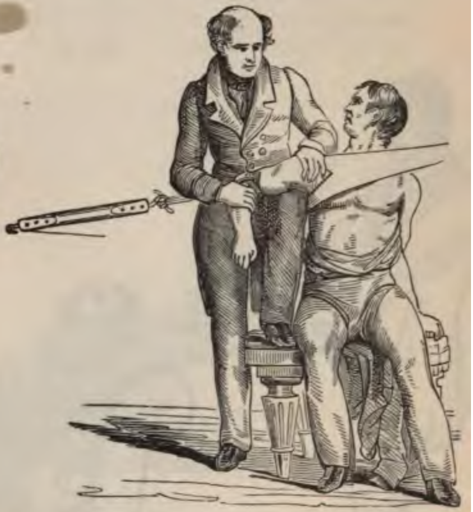
Treatment.—There are many methods of reducing dislocation of the shoulder: 1. **Simple Extension.**—A towel is passed around the chest, under the arm and crossed above the shoulder, so as to firmly fix the scapula; another towel is fastened around the arm above the elbow; extension is then made with the latter, the patient sitting.

FIG. 44.



Dislocation of the Humerus Downward.

FIG. 45.



Reduction of Dislocation of the Humerus.

When extension is made for a few minutes, gently roll, shake and lift the head of the bone with the knee.

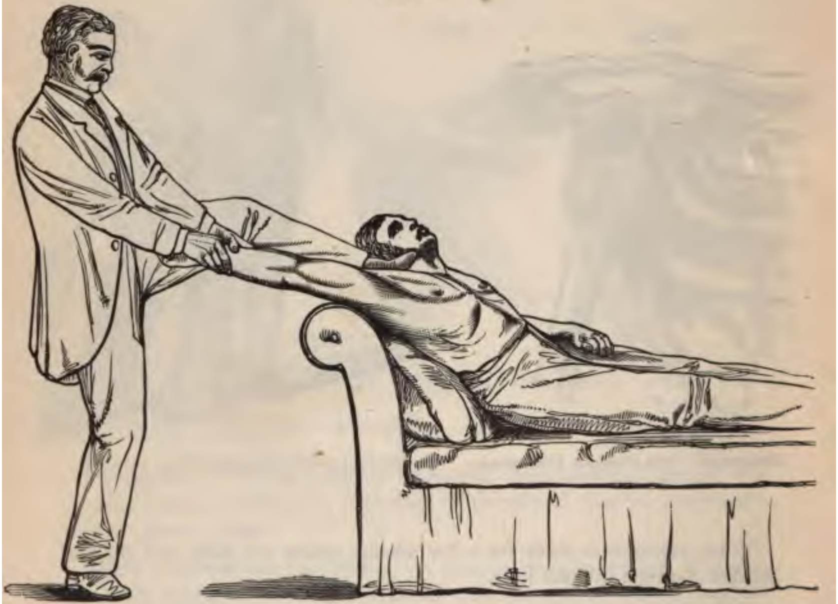
2. **Heel in the Axilla.**—Professor Brinton prefers the following method: Place a soft pad in the axilla, then make pressure with the heel partially against the pad, and partially against the wall of the chest, pushing the head of the bone upward and outward, and at the same time pulling the limb downward, and a little forward, by means of a towel secured around the arm above the elbow.

3. **Knee in the Axilla.**—The patient is seated in a chair, and the surgeon places one knee in the axilla, resting his foot on the chair. He then puts his

hand on the shoulder, to fix the scapula, and with the other depresses the elbow over his knee.

4. **Reduction by the Perpendicular Method.**—Place the patient in a low chair, or on a couch, and raise the arm *perpendicularly by the side of the head*, at the same time fixing the acromion, and making gentle traction upward. If little force is required the arm can be taken in one hand, and the acromion can be steadied with the other. Should more force be necessary an assistant may steady the shoulder and the surgeon use his foot, as exemplified in the preceding figure. When the bone is felt to slip into its place the arm must be brought down to the side while the head of the bone is held outward by the hand in the axilla.

FIG. 46.



Perpendicular Reduction.

***Kocher's* Method.**—The forearm is flexed upon the arm, then turned outward as far away from the chest as possible; the elbow is then carried well forward and upward. Rotate the arm inward and lower the elbow, when the head of the bone will probably fall into place. This manipulation may be employed without resorting to an anæsthetic.

The extension used in any dislocation *forward* must be made in a direction downward and backward. For dislocation backward the extension must be made forward.

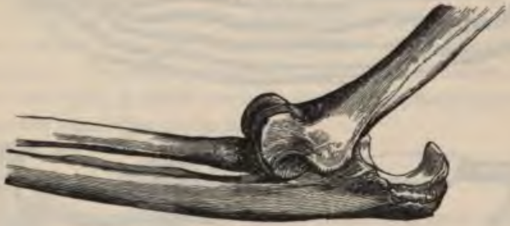
After reduction a small pad should be placed in the axilla, and the arm and shoulder supported for some days with a sling, and a roller to confine the arm to the trunk.

DISLOCATIONS OF THE ELBOW.

The elbow may be dislocated in five directions.

First. Both bones backward, strongly marked by alterations in the form of the joint and loss of motion; there is considerable projection formed posteriorly by the ulna and radius; on each side of the olecranon there is a hollow; the hand and forearm are in a state of supination and cannot be turned prone.

FIG. 47.



Dislocation of the Ulna Backward.

Second. Lateral dislocation of both bones of the forearm; ulna thrown on either the external or internal condyle. There is great distortion and increased width of the joint; the forearm is flexed and pronated. In dislocation outward the radius forms a prominent swelling, and in dislocation inward there is marked and elongated projection on the inner side of the joint.

Third. The third dislocation is ulna backward. The deformity is very great; the forearm and arm are twisted inward, and the olecranon projects considerably. The forearm cannot be extended, nor bent to more than a right angle.

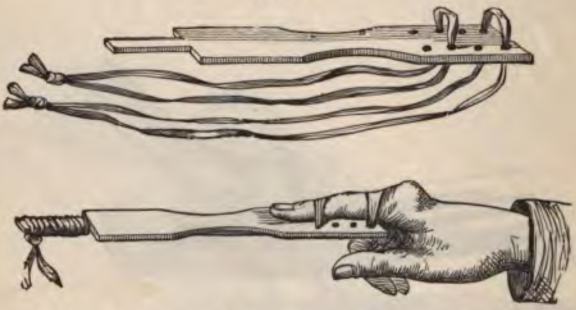
Fourth. The radius thrown forward into the hollow above the external condyle of the humerus. The forearm in this dislocation is slightly bent, but cannot be brought to a right angle. The hand is between pronation and supination.

Fifth. Radius backward. Very rare and seldom seen.

Treatment.—The first, second, and third dislocations may be reduced by seating the patient on a chair; then take hold of his wrist; put your knee on the inner side of the elbow joint; bend the forearm, and at the same time make pressure upon the dislocated bones, so as to separate the coronoid process of the ulna from the posterior fossa of the humerus. While the pressure is kept up by the knee, the arm is forcibly and gradually bent, and the bones will slip into their places.

In the fourth dislocation the hand should be turned supine, the forearm should be bent, and extension made from the hand, without including the ulna.

FIG. 48.



Reduction of Dislocation of Index Finger, and Apparatus for the same.

DISLOCATIONS OF THE WRIST.

are of three kinds, viz.: both bones; radius forward; and the ulna backward. They are readily distinguished by the altered position of the hand, which is thrown either backward or forward, or twisted on its axis.

They are reduced by simple extension.

DISLOCATIONS OF THE FINGERS AND TOES.

These are accidents of rare occurrence. When dislocations of the fingers take place they are generally found between the first and second phalanges.

The diagnosis is easy when the dislocation occurs at this place; there is a projection of the first phalanx backward, while the head of the second phalanx can be felt on the fore part, though less distinctly.

If the dislocation has occurred within a few hours of the surgeon's seeing it, as a rule, it can be readily reduced; but if it has been neglected, the reduction can only be accomplished by long-continued and steady extension.

After reduction, the finger should be rolled with tape, surrounded and supported with pasteboard; the hand and forearm should be kept in a sling.

It is more difficult to reduce dislocations of the toes than the fingers.

DISLOCATIONS OF THE THUMB.

In dislocation of the first phalanx of the thumb, it will be found thrown back upon the metacarpal bone, where it forms a projection; the lower part of the metacarpal bone projects inward; the thumb is shortened and can neither be bent nor extended; the last phalanx is usually flexed.

Extension and counter-extension are the usual means employed to reduce this dislocation. Extension may be made by means of the clove hitch, secured over a wet cloth and counter-extension with a strong cloth, the fold resting on the palm of the hand, and the ends crossed behind the wrist and brought around to the front of the forearm, and held by an assistant. Should more powerful extension be required, it may be obtained by means of Charriere's forceps or Levis's apparatus. The method of Professor Crosby, which consists in pushing the phalanx back until it stands perpendicularly on the metacarpal bones, frequently succeeds when other modes fail.

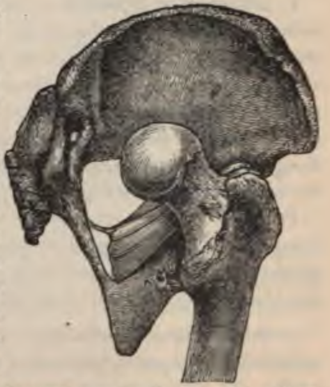
DISLOCATIONS OF THE HIP JOINT.

There are four dislocations of the thigh bone; viz., *upward on the dorsum of the ilium; downward into the thyroid foramen; backward* and *upward* into the ischiatic notch; and *forward* and *upward* on the body of the pubis.

First. Upward, on the *dorsum of the ilium*, happens more frequently than any other dislocation of the hip joint.

The characteristic symptoms are, a difference in the length of the limb, a change of position inward, a diminution of motion, and flattening. The toes rest upon the tarsus of the opposite foot; the knee and foot are turned *inward;* the knee slightly advanced on the other; the limb an inch and a half to two inches and a half *shorter* than the other, and the legs cannot be separated.

FIG. 49.

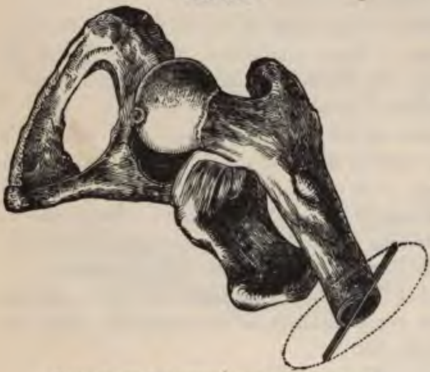


Dislocation on the Dorsum of the Ilium.

Second. Dislocation downward, into the thyroid foramen. The dislocated limb is two inches longer than the other. In thin persons the head of the thigh bone can be felt on pressure. There is flattening of the hip, and the body is bent forward. The toes point to the ground; the foot is *turned outward or inward.*

Third. Backward, into the sciatic notch. The head of the bone is placed on the pyriformis muscle. The limb is from half an inch to an inch *shorter* than the other; the toe rests on the ball of the great toe on the opposite foot. The knee and foot are turned *inward;* the toe, but not the heel, touches the ground when standing. Very little flexion and rotation can be made.

FIG. 50.



Dislocation Backward into Sciatic Notch.

Fourth. Dislocation *on the pubes.* The limb is shorter than the other; the knee and foot are turned *outward*, and cannot be rotated inward; the head of the thigh bones is readily felt on the pubes.

Treatment.—These dislocations may be reduced by manipulation or by force; the former is the plan most in vogue.

1. **Dislocation Upward.**—The manœuvre by which a dislocated hip can be reduced consists in employing the length of the limb as a lever and the trochanter as a fulcrum, by which the head may be got into such a position as to slip into its socket. The knee must be bent on the thigh, and the thigh on the pelvis; the surgeon then, grasping the ankle with one hand and the knee with the other, causes the thigh to perform a circumduction movement toward abduction, finishing with a rotatory movement of the femoral axis, when the head of the bone will probably slip into its place.

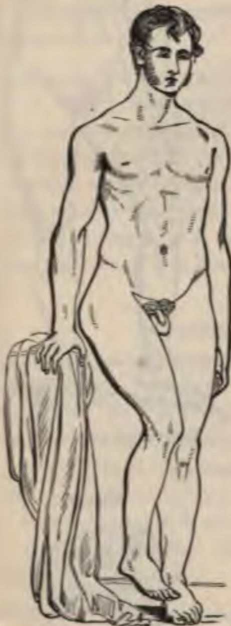
Professor Bigelow recommends that the thigh be first flexed with a little inward rotation, producing inversion of the toes, and then the thigh should be abducted, circumducted, and at the same time rotated outward. This has been described in the directions, "*lift up, bend out, roll out.*"

2. **Dislocation Downward.**—Rotation inward of the flexed and slightly abducted thigh upon the fulcrum of the Y-shaped ligament.

3. **Dislocation Backward.**—Bigelow reduces this dislocation by *circumduction* of the flexed thigh *inward*, so as to unlock the head of the femur, and then abducts and everts the limb with an upward jerk.

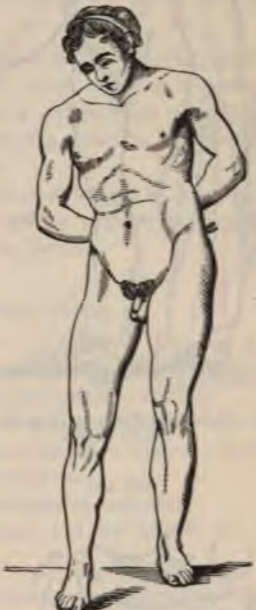
4. **Dislocation on the Pubes.**—Flexion combined with abduction may be tried; if the pulleys are used the patient is to be laid on the sound side; extension should be made in a direction backward and outward, and counter-extension in front of the patient; after it has been continued a little time, the head of the bone should be lifted over the edge of the acetabulum by means of the napkin.

FIG. 51.



Dislocation Upward, on the Dorsum of the Ilium.

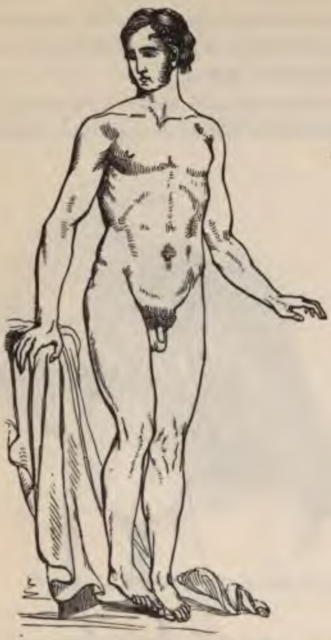
FIG. 52.



Dislocation Downward, into the Thyroid Foramen.

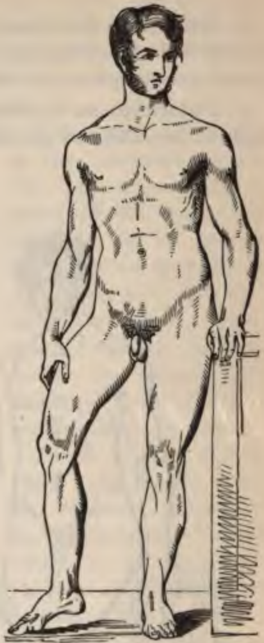
In these dislocations, if the method by manipulation fails, recourse must be had to force, which is usually effected by employing extension and counter-extension by means of traction, through the medium of pulleys, etc. For a

FIG. 53.



Dislocation Backward, into the Sciatic Notch.

FIG. 54.



Dislocation on the Pubes.

FIG. 55.

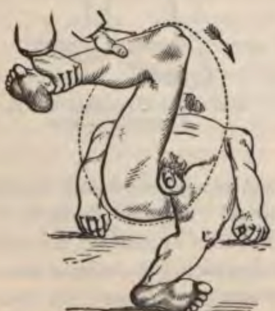
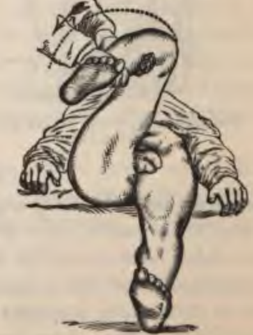


FIG. 56.



Manipulations for Reduction of Dislocation of Hip.

full account of these different modes of applying the necessary counter-extending bands, etc., the student is referred to the larger works on Surgery.

DISLOCATIONS OF PATELLA.

The patella may be dislocated outward, upward, or inward.

It is most frequently thrown on the *external* condyle, and there produces a great projection; the dislocation on the *inner* condyle is less frequent; in dislocation of the patella upward, the ligamentum patella is torn through and the patella is drawn up.

Treatment.—In the reduction of the two first dislocations, the patient is to be placed in the recumbent position, the leg raised by lifting it at the heel, and then press on the edge of the bone that is furthest from the articulation. Evaporating lotions are to be employed when the reduction is accomplished, and a bandage should be worn for a few days.

In dislocation of the patella upward, the bone is to be kept in contact with the ruptured ligament, and inflammation must be prevented by appropriate remedies, and then treated like a fracture of the patella.

DISLOCATIONS OF THE KNEE.

There are four dislocations of the knee:—

First dislocation is *inward;* the tibia projects on the inner side of the joint, and the condyle of the femur rests on the external semilunar cartilage.

The *second dislocation* is where the tibia is thrown on the *outer* side of the joint; the condyle of the femur being placed on the inner semilunar cartilage.

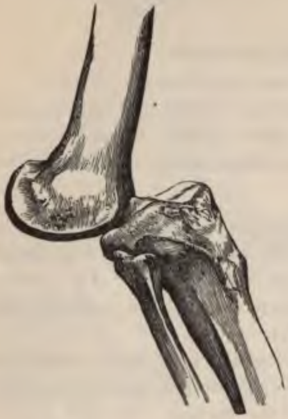
In the *third dislocation* the tibia is dislocated forward.

The *fourth dislocation* is when the tibia is dislocated backward.

The symptoms in these cases are obvious, and the injuries are easily recognized.

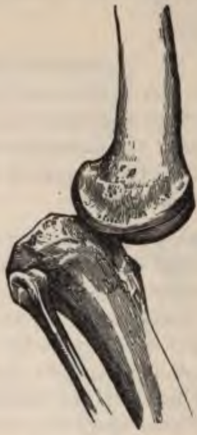
Reduction.—Each of these dislocations may be reduced by simple *extension.* There is a great tendency to inflammation in these injuries, for which proper antiphlogistic remedies must be used; perfect rest must be enjoined; iced water, or lead water and laudanum, and such like measures must be resorted to; leeches applied, if necessary.

Fig. 57.



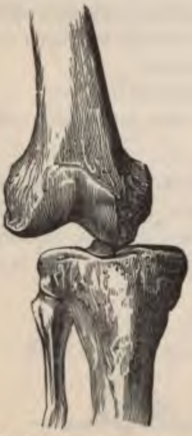
Dislocation Forward.

Fig. 58.



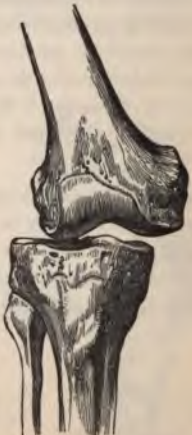
Dislocation Backward.

Fig. 59.



Dislocation Inward.

Fig. 60.



Dislocation Outward.

DISLOCATIONS OF THE ANKLE JOINT.

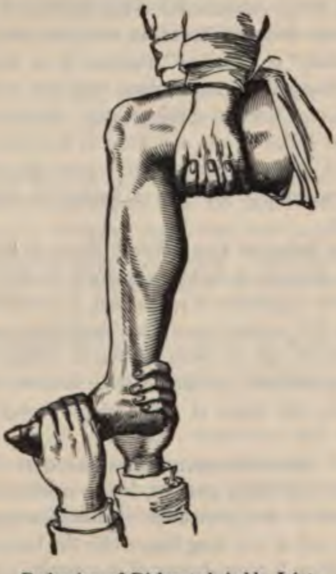
The usual dislocations at this joint are *inward*, *outward*, and *forward*, but there may be a backward dislocation.

The dislocation *inward* is the most frequent; the foot is thrown *outward* and its inner edge rests upon the ground; the internal malleolus projects against the integuments. The foot rotates easily.

The dislocation *outward* is the most dangerous; the foot is thrown *inward*. The malleolus projects very much. The toes and foot are pointed downward. This dislocation is accompanied by fracture of the internal malleolus.

In dislocation *forward*, the foot appears *shortened* and fixed, and the toes are pointed to the ground; the lower end of the tibia forms a hard swelling on the middle tarsus; the heel appears lengthened.

FIG. 61.



Reduction of Dislocated Ankle Joint.

Treatment.—To reduce the dislocation *inward*, place the patient on a mattress, bend the leg at right angles to the thigh, let an assistant grasp the *foot and gradually* draw it in a line with the leg. At the same time, fix the thigh and press the tibia downward. After reduction, support the foot with a many-tailed bandage, keep parts cool, etc.

For dislocation *outward*, reduce the dislocation as above directed, then lay the limb on the outer side, resting it in splints with foot-pieces.

In dislocation *forward*, the treatment must be followed by rest. In five weeks the patient may be allowed to get up and use passive motion.

FRACTURES.

A **Fracture** is the division of a bone into one or more pieces, from violence.

A fracture is *simple* when there is no wound communicating with it; *compound* when there is such a wound; *transverse* when the line of fracture lies across the bone; *oblique* when it slopes; *longitudinal* when it is more or less parallel to the long axis; *comminuted* when broken in several fragments; *complicated* when there is laceration of an artery or joint, or other additional injury. A "*green stick*," or "*willow*" fracture, is an incomplete fracture, in which some of the bony fibres have given way and the rest are bent, but have not broken. It is a fracture of the young. An *impacted* fracture is one in which one fragment is driven into and fixed in the other.

When occurring in the neighborhood of a joint, the terms *intra-capsular* and *extra-capsular* are used, as the line of fracture is internal or external to the capsular ligament.

If the same bone is broken at two different places, or more than one bone is broken in the same limb, it is called a *multiple* fracture. If cracked only, without displacement or separation of periosteum, it is called a fissure.

The circumstances that render bones more liable than usual to be broken are atrophy arising from old age, or from prolonged disease of a limb; certain diseases, as fatty degeneration, rickets, *mollities ossium*, syphilis, and cancer; original conformation; the bones of some people being more delicate than others.

EPIPHYSEAL SEPARATION

is met with in infants and young persons, before ossification is completed. It most frequently occurs at the extremities of the humerus, radius, femur, and tibia. The ossifying end of the long bone, with the layer of connecting cartilage, is detached. There is great danger of suppuration; the periosteum being stripped from the shaft of the bone. The displacement is sometimes very great and reduction is difficult; it is frequently followed by diminished growth, shortening, deformity, and impairment of movement. It is not unfrequently met with in infants who are the subjects of hereditary syphilis, or those who are suffering from acute rickets or infantile scurvy.

The most common cause of this affection is a wrench of the part, violent traction, or a severe fall.

The symptoms are those of fracture. In the young subject its existence may be suspected when the ends of the fragments are transverse, or nearly so; when the lower fragment retains its position, while the upper moves about; and when the crepitation produced by rubbing the ends of the fragments together is of an unusually dull, rough, grating character. In young persons union takes place promptly.

SIGNS OF FRACTURE.

Signs of fracture are *Deformity*, *Mobility*, *Crepitus*, *Loss of Function*, *Pain*, *Discoloration*, and *Disordered Sensibility*.

1. **Deformity** may exist in *length*, *rotation*, and *angularity; shortening* is produced by muscular action, and is the most common form of displacement; it may be so slight as to require careful measurement for its detection. *Rotation* is usually external, and is caused by the weight of the limb. *Angularity* is the worst form of deformity: the principal indication for treatment is to overcome deformity.

2. **Mobility** in an abnormal position is a frequent sign of fracture. Care must be taken not to confound the mobility of a fracture with the normal action of a joint.

3. **Crepitus** is the most decisive sign of fracture; in a broken bone it is a rude and rough sound, which can be both felt and heard. Do not mistake the crepitus arising from a fractured bone, and that produced by a roughened cartilage, or the inflamed theca of a tendon. Crepitus cannot be obtained in impacted fractures, nor after the formation of callus, or the rounding of the ends of a bone.

4. **Loss of function** is an important, but by no means an infallible sign.

5. **Pain** is always present to a greater or less degree; it is severe, concentrated, and localized.

6. **Discoloration** is of two kinds: *immediate* and *secondary*. The first is the result of injury to the subcutaneous veins, and frequently involves the entire limb; the second appears several days after the injury, and proceeds from the blood-vessels that surround the fractured bone; it is an important sign of fracture.

7. **Disordered sensibility** frequently exists; there may be tingling in the parts from pressure on nerves.

REPAIR OF FRACTURE.

The first result of a fracture is an effusion of blood between and around the broken ends; then follows a period of exudation, in which plastic lymph and leucocytes are effused; after this the lymph is developed first into fibroid tissue, interspersed with osteoid or cartilage cells, and then into bone. The periosteum, medullary membrane, and surfaces of the broken bone are the principal agents in the production of the bone-forming cells. The time required for the completion of the union of broken bone varies from four to ten weeks; being less in the young and healthy. The last stage in the process of repair is the absorption of superfluous bone, and the restoration of the cancelli and medullary cavities. This is completed in from six to twelve months.

The material by which fractures are first united is called *callus.*

The neck of the thigh bone, the olecranon, the acromion, coracoid and coronoid processes, the tuberosity of the os calcis, and the patella do not, as a rule, unite by bone. The reasons given for this are, 1st, the great difficulty in keeping these broken surfaces in contact; 2d, in bones that enter into the formation of joints contact is prevented by the displacement and separation caused by the abundant effusion of synovial fluid into the joint and between the broken surfaces of bone.

If considerable portions of the skull be removed, the gap is not entirely filled up.

GENERAL TREATMENT OF FRACTURES.

The sooner reduction is accomplished the better; there is then less swelling and sensibility, the muscles have not had time to become irritated, and the diagnosis is more plain. Should swelling have taken place before the patient has been seen by the surgeon, place the part in a comfortable position, and let it so remain until the swelling has subsided.

To get the fragments in position employ extension, counter-extension, and coaptation. Apply extension to the distal extremity by steady, continual traction. Counter-extension is the force employed to counteract the extending force. Do not grasp the part immediately beyond the seat of fracture, otherwise muscular resistance will take place. Coaptation is the pressing of the ends of bones into position.

To keep the parts in position it is often necessary to keep up extension and counter-extension after adjustment. The different articles used for dressings are: *Thin Board* (⅓ inch) of pine or poplar; *Binder's Board*, which gives sufficient support and can be readily moulded by soaking in hot water; flannel saturated with glue and plaster; unoiled leather; sheet rubber, tin, or copper.

The Plaster Dressing consists of crinoline bandages, rolled up loosely in plaster, placed in water until thoroughly wet, and then squeezed dry as possible. Protect the limb with plenty of cotton and then apply the bandage.

A fracture should be disturbed as little as possible, but it should be thoroughly examined on the second and third day. When the swelling has subsided the bandages should be tightened; after which the patient should be seen daily.

UNUNITED FRACTURES.

These may result from constitutional or local causes; the constitutional causes are many, such as typhoid fever, delirium tremens, scurvy, pregnancy, lactation and shock, which is a very frequent constitutional cause. The *local* causes are too much handling, or otherwise disturbing the fragments; too light, or too loose dressing; interposition of a foreign body between the fragments; necrosis.

The treatment of an ununited fracture consists in creating irritation about the fragments, so as to invite blood to the part and encourage the formation of a new deposit of callus.

There are a variety of methods recommended: 1st, by rubbing the fragments together and then treating the limb as in primary fracture. 2d, Brainerd's method, which is the subcutaneous introduction of an awl-shaped drill, perforating the bone from one fragment to the other; several perforations of the bone are to be made, but only one external opening. 3d, The introduction of acupuncture needles, and the passage of an electric current through them. 4th, Drilling the fragments together with a gimlet, and allowing it to remain in the bone from one to four weeks. 5th, Excision of the ends of the bone. 6th, Applying a plaster dressing, or Smith's splint, and putting the patient on his feet with crutches, when attrition takes place, and irritation is effected.

The simplest method should be first tried.

FRACTURES OF THE UPPER JAW.

The superior maxilla is seldom broken, unless great and direct violence has been employed; its fracture is generally accompanied by external wound, as in gunshot injuries or a kick from a horse. The fracture is often comminuted and is sometimes attended with concussion of the brain, or with fracture of other bones of the face; it is often produced by force transmitted from the malar bone, the latter remaining sound.

The superior maxilla possesses extraordinary reparative powers.

Treatment —Preserve and replace all fragments and splinters, the tendency to heal being very great.

The patient must avoid chewing any hard substances until the detached fragment has become attached to the bone. When the alveolar process is broken into two or more fragments, the pieces must be pressed into place and the jaws closed, so that the lower jaw may serve as a support. To maintain apposition apply a Barton or Gibson bandage. It may be necessary to apply fine wire to the teeth, if displacement continues; or an interdental splint composed of gutta-percha may be used. Loosened teeth must be pressed into their places.

Should the nasal process be broken, a director should be applied through the nose to elevate any depression that may exist.

FRACTURE OF THE ZYGOMATIC ARCH.

This accident is rare, and is produced by direct violence, usually occurring on the temporal side of the suture.

The signs of this fracture are an irregular projection or depression of the fragments, with rapid swelling of the parts. The displacement will occur either outward or inward.

There will be neither motion nor crepitus.

Treatment.—Should there be no displacement, apply an anodyne lotion, and keep the parts quiet with a Gibson or Barton roller.

If there be outward displacement, the fragments may be adjusted by pressure on the projecting angle, afterward applying a soothing lotion. If the displacement is occasioned by depression of the malar bone, it will be adjusted by restoration of that bone to its proper position, which requires extensive manipulation. The question of surgical interference must depend upon the urgency of the symptoms.

FRACTURES OF THE NASAL BONES.

The nasal bones are, from their situation, much exposed to fracture.

Signs.—Before swelling supervenes, the appearance of the nose will likely be characteristic of the injury; there will be displacement and *mobility* of the fragments, with crepitation when held lightly by the fingers. Hemorrhage from the nose is apt to be persistent and more or less profuse; if the injury extend to the lachrymal bone, there will be profuse discharge of tears. Symptoms of concussion may accompany the fracture.

Treatment.—If there be no displacement of the bones, cold applications of lead water and laudanum or other soothing lotion will be all that is necessary.

Should displacement exist, the bones must be adjusted by manipulation, assisted by a ring-handled forceps, metallic sound, female catheter, or some other such article, passed into the nostrils; using it as a lever, the fragments are pushed outward while the parts are manipulated with the left hand.

Persistent hemorrhage must be controlled by plugging the nares anteriorly and posteriorly.

As a rule, the fractured bones will retain their situation without further assistance; if they do not, they may be supported by the introduction of oiled lint.

If the fracture be compound, loose splinters detached from the periosteum should be gently removed.

Leeches, purgatives, and cold lotions may be necessary to relieve swelling, bleeding from the nose, ecchymosis and headache.

FRACTURES OF THE LOWER JAW.

The lower jaw may be fractured at the symphyses; through the body to one side of the symphysis; through the angle; at the coronoid process; or at the neck of the condyle.

The most common site of fracture is the body of the maxilla, toward its anterior extremity.

The condyle, neck, and coronoid process are seldom broken.

This injury is caused by direct blows; falls on the chin; gunshot wounds; kicks from a horse; or in extracting teeth.

Sometimes these fractures are double.

Symptoms.—Great mobility of the fragments, pain, swelling, crepitus, inability to use or move the lower jaw; irregularity of the teeth and of the line of the jaw; dribbling of the saliva; inability to speak; laceration of the gums and mucous membrane, accompanied with bleeding; the teeth loosened at the point of fracture. The crepitus is felt on moving the chin with the hand placed on the posterior fragment.

The displacement is greater when the fracture is near the symphysis; if on one side only of the middle line, the smaller fragment is liable to be drawn outward and forward. When the angle or ramus is the seat of fracture there is little or no deformity, but crepitus is perceptible to the patient. When the neck of the condyle is broken, there is marked displacement upward, inward, and forward by the action of the pterygoid, the chin being turned *toward* the affected side; in *dislocation* it is *turned away from it.*

Treatment.—It may be necessary to wire the teeth together, in order to retain the fragments in proper position. A piece of pasteboard or gutta percha, cut into proper shape and softened in boiling water, must be accurately fitted to the jaw. Then a four-tailed bandage must be applied, or a Barton or Gibson bandage, at the option of the surgeon.

In fracture at the junction of the body and the ramus of the inferior maxillary bone, a pad is to be placed back of the angle and a crossed angle bandage applied. (See page 281.)

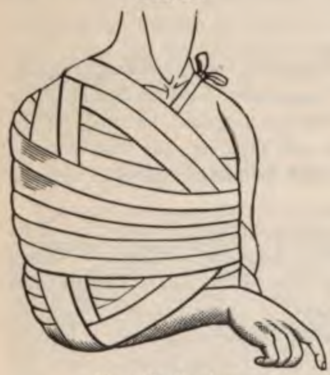
During the cure the patient must be kept quiet and fed upon spoon diet, which should be continued until the bone is firmly united. Broths, soups, jellies, tea, milk, etc., are the most eligible.

FRACTURES OF THE CLAVICLE.

A Fracture of the Clavicle is usually caused by indirect violence, such as falls on the arm or shoulder; it is generally oblique in direction; it may be caused by direct violence, when it is commonly seated near the acromial extremity.

Symptoms.—The shoulder sinks *downward*, *forward*, and *inward;* the distance from the acromion to the sternum is less on the injured than on the sound side. In consequence of the sinking of the shoulder and the outer fragment, the sternal portion of the bone projects over the fractured extremity, and it may be distinctly felt by tracing the usual course of the clavicle with the finger.

Fig. 62.



Desault's Bandage.

Treatment.—A fractured clavicle is easily reduced, but the difficulty is to retain the broken ends in exact apposition.

The arms and shoulders of the patient are to be firmly drawn backward by an assistant, when the fractured extremities come in apposition; the shoulders must be raised and supported in a direction *upward*, *backward*, and *outward*. The parts are to be then covered with adhesive plaster, and a bandage is to be applied, to retain them in their reduced apposition.

Sayre's dressing and the apparatuses of Drs. Fox, Levis, and Boyer, and the Velpeau bandage and that of Desault, are those most in vogue. See page 304, Sayre's Dressing of Fractured Clavicle.

FRACTURES OF THE STERNUM.

This bone is rarely fractured; but a single case was admitted into the Hôtel Dieu in eleven years, and out of 1901 fractures received into the Middlesex *Hospital, but two were* fractures of the sternum.

The ordinary causes of fractures of the sternum are blows, kicks, and falls. A fracture of this bone is rendered evident by the inequalities perceptible when the surface is examined by the fingers. It is also characterized by a depression or elevation of the broken pieces, crepitus, and unusual mobility of the injured part in respiration. The breathing is difficult, and frequently accompanied with cough, spitting of blood, and inability to lie on the back. Discoloration and swelling soon follow the accident.

Treatment.—The application of compresses and an immovable bandage, to afford support to the chest and quietude to the intercostal muscles, are the indications.

In cases attended with great depression of the fractured bone, it may become necessary to elevate it.

FRACTURES OF THE RIBS

are generally caused by direct violence, and are usually situated in the anterior half; they may, however, be caused by indirect violence, as when the chest is forcibly compressed.

Symptoms.—Fixed lancinating pain, increased by inspiration, coughing, and other motion. Crepitation, which will be present, may be ascertained either by placing the hand over the seat of injury, and directing the patient to attempt a full inspiration or a prolonged expiration, or by auscultation.

When the lung is wounded, there will be emphysema over the exterior of the chest, which will be detected by the peculiar crackling which is heard when the skin is pressed upon. If the wound be deep, there will be hæmoptysis. In stout persons, or where the fracture is near the spine, it may be difficult of detection.

Treatment.—The indications are: 1st. *Diminish motion* of the ribs, and give support to the part, the respiration being performed by the diaphragm. The best is the adhesive plaster dressing, applied in strips from two to two and a half inches wide, extending over the affected side from the spine to the middle of the sternum; they should support the fracture and cover two or three ribs above or below the seat of injury. Or a broad flannel roller may be used, or the plaster splint.

The arms should be confined to the side, to prevent motion of the scapula.

2d. To *prevent inflammation* of the chest, keep respiration easy, and relieve pain by rest in bed, purgatives, and opiates if necessary.

FRACTURES OF THE SCAPULA.

The **Scapula** is so much covered with muscle, and its connections with the trunk allow so much yielding on the application of external force, that fractures of this bone are extremely uncommon. The injury may occur to its *body*, its *inferior angle*, its *neck*, to the *acromion* process, or the *coracoid* process. In fracture of the body of the bone the shoulder will be depressed and forced forward, and there will be marked irregularity between the ends of the fragments. Fracture of the *inferior angle* is marked by preternatural mobility, by displacement of the smaller fragment, and by acute pain at the seat of injury. In *fracture of the neck*, the acromion is unusually prominent, the head of the humerus is felt in the axilla, the shoulder is flattened, the limb is lengthened, the coracoid process is found below the clavicle, severe pain and numbness are experienced in the axilla, and distinct crepitation is perceived on rotating the arm upon the scapula. In fractures of the *acromion* and of the *coracoid*, the symptoms are somewhat similar to those presented by the fracture of the neck.

Treatment.—When the *body* is broken, a broad roller must be passed round the trunk, over a large, flat pad placed over the scapula, and a few turns made around the arm, so as to fix it to the side and prevent motion. Rest and quietude are required. Or a broad strip of adhesive plaster should be applied across the scapula, extending from the spine to the sternum, care being taken to press it well down along the anterior and posterior borders of the bone before the portions in front and behind the chest have been attached. Then place the arm in a Fox apparatus, and allow it to hang vertically along the side of the body, at the same time lifting the elbow by securing the straps to the ring on the opposite shoulder.

In *fracture of the neck* the shoulder must be supported by the sling and bandage that are used for fracture of the clavicle, but the pad should not be so thick, nor so large, and in addition a short sling should be used, going from the axillary pad on the injured side to the opposite shoulder. Opium, rest, leeches and purgatives may be necessary for the contusion with which this fracture is accompanied. At the end of four weeks passive motion must be made, to establish the functions of the joint.

In fracture of the *acromion* the bandages are to be so applied as to raise the elbow thoroughly, so that the head of the humerus may be lifted up against the acromion and keep its place. A pad must *not* be placed in the axilla, otherwise the broken part will be pushed too much outward.

When the *coracoid* process is fractured, the humerus must be brought forward and inward, so as to relax the coraco-brachialis, and must be confined to the *trunk*, with the forearm bent on the chest.

FRACTURES OF THE HUMERUS.

The **Humerus** may be fractured at any point.

FRACTURE OF THE ANATOMICAL NECK.

Fracture through the anatomical neck is rare; it may be impacted or non-impacted.

In the *impacted* form the upper fragment is driven into the cancellous tissue of the lower portion.

Symptoms.—The axis of the humerus is altered, being directed toward the coracoid process; the elbow is slightly separated from the side; the arm is shortened; the shoulder flattened; the acromion is more prominent than usual; the head of the humerus can be felt in the glenoid cavity; there is no crepitus.

In the *non-impacted* form there is less deformity; there is a slight projection on the inner aspect; there is crepitus on rotation.

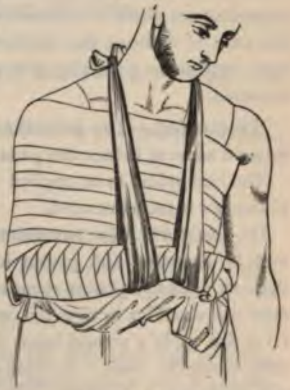
Treatment.—In the impacted fracture keep the part at rest by bandaging the arm to the side and supporting the elbow in a sling. In the non-impacted fracture it will be necessary to fix a small pad in the axilla and adjust a felt cap to the shoulder, so as to keep the parts in apposition and completely at rest.

FRACTURE OF THE SURGICAL NECK.

Care must be taken not to confound this fracture with luxation of the bone downward and inward; in fracture of the neck the shoulder retains its natural form; the acromion does not project and the depression is below the point of the shoulder; in dislocation there is a deep depression below the projection of the acromion, in the natural situation of the head of the humerus.

Symptoms.—The lower fragment forms a distinct prominence beneath the coracoid process, especially when the elbow is raised; the head of the bone can be felt in the glenoid cavity; there is a slight depression just below the end of the fragment; the axis of the limb is altered, being directed upward and inward toward the coracoid process; there is *crepitus* on extending and

FIG. 63.



Fracture of Neck of Humerus.

rotating the limb; the arm is shortened and unnaturally mobile; pain shooting down the arm is often present.

Treatment.—To support the weight of the limb, and keep it firmly fixed to the side, are the most effectual means of maintaining apposition; for this purpose, a thin pad, a compress, or a folded towel should be placed in the axilla, which must be held in its place by a bandage or by adhesive strips; the arm is then brought to the side, the elbow somewhat forward. The arm must then be securely fastened to the chest with circular turns of the roller, and the forearm placed in a sling.

FRACTURE OF THE SHAFT.

The existence of this fracture is easily ascertained; the head of the bone being grasped with one hand and the elbow with the other, upon rotating the arm no motion will be communicated from the lower to the upper portion, and crepitus will be distinguishable.

Treatment.—Use a well-padded internal angular splint, a cap of felt adjusted to the shoulder and extending down to within two inches of the elbow joint, to be secured by a well-fitted roller; the forearm placed in a sling. Professor Brinton does not advocate the bandaging of the forearm and arm before applying the splint; other authorities do.

FRACTURE OF THE CONDYLES.

When the condyles are obliquely broken off, just above the joint, the appearances are those of a dislocation of the radius and ulna backward; but in the case of fracture, the displacement recurs when the extension is remitted, and crepitus is generally perceptible when the forearm is rotated upon the humerus.

Treatment.—The indications in these cases are to bend the arm, draw it forward so as to reduce the parts, and then apply a roller.

The best splint to be applied is an L-shaped anterior splint; that known as Hewson's is recommended.

Dr. Oscar H. Allis recommends, in fracture of the inner condyle, that the limb be extended and placed in an easy, natural position, and then to apply strips of adhesive plaster about an inch wide, and long enough to extend from near the shoulder to near the wrist, so as to cover the surface of the limb. Over this apply a second layer, thus having two layers of longitudinal adhesive strips about the joint. In some cases he has applied a layer of cotton batting, and over this a bandage. The most beneficial results are claimed for this method of treatment.

In adults it is sometimes necessary to resort to a firmer dressing; when this is the case, instead of using adhesive plaster, surround the joint with a thick layer of cotton and apply an egg-paste dressing.

With this mode of treatment passive motion should not be employed before the expiration of the seventh or eighth week.

FRACTURES OF THE FOREARM.

FRACTURE OF THE OLECRANON.

Symptoms.—There is loss of full power to extend the arm; the olecranon process will be above the line that connects the two condyles; the fragment is drawn upward by the triceps; a hollow is felt at the back of the joint. The upper fragment is not affected by flexion.

Treatment.—Extend the arm, and with the fingers bring the fragment down. Apply adhesive strips in the form of a figure 8 around the elbow, and a roller extending to the shoulder. Then apply an anterior splint of a slightly obtuse angle, padding it thickly opposite the joint; secure the splint by broad straps of adhesive plaster and a bandage. Retain the dressing for six weeks. Passive motion must be very slight, and not commenced until between the fourteenth and twenty-first day.

FRACTURE OF THE CORONOID PROCESS.

This fracture is very rare.

Symptoms.—Difficulty of bending elbow and dislocation of the ulna; the olecranon projecting backward.

Treatment.—The arm must be bandaged and kept at rest in the bent position. Union ligamentous.

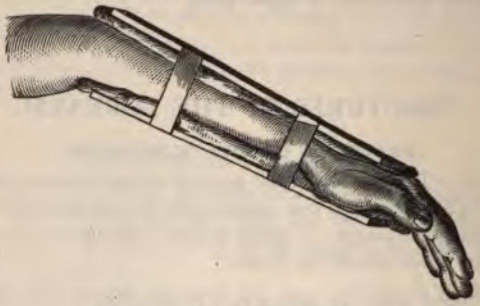
FRACTURE OF THE SHAFTS OF THE RADIUS AND ULNA.

These bones may be both broken together, or they may be fractured singly. Easily recognized by the ordinary signs of fracture, especially crepitus, felt on fixing the upper end and rotating or moving the other.

Treatment.—The indications are to prevent the fractured end of either bone from being pressed inward toward the interosseous space and to prevent the upper fragment of the radius from being more supinated than the lower.

The elbow must be bent, and the forearm placed in a position intermediate between pronation and supination, the thumb pointing upward; one splint should be applied to the flexor side, from the inner condyle of the humerus to the tips of the fingers, and another from the outer condyle to the back of the wrist. Both splints must be wide and well padded *along the middle*, so as to prevent the bones from being pressed together by the bandage.

FIG. 64



Fracture of the Radius and Ulna.

FRACTURE OF THE NECK OF THE RADIUS.

This is exceedingly rare when uncomplicated with any other fracture.

Mobility and crepitus will be perceptible, with flexion of the forearm, with loss of pronation and supination.

Treatment.—The forearm must be flexed upon the arm; a compress applied over the lower fragment, at the seat of injury: an *anterior angular* splint adjusted to the part, and over this a roller bandage. The arm must be kept in a sling.

FRACTURE OF THE LOWER EXTREMITY OF THE RADIUS.

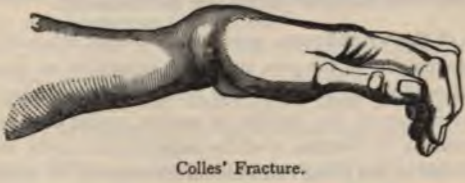
This fracture is from half an inch to an inch above the wrist, and transverse in its direction; is generally known as Colles' fracture; when the fracture is very oblique, extending from the articulation upward and backward, it is called Barton's fracture, from the name of the surgeon who first accurately described the injury.

Treatment.—The splints of Drs. Barton, Bond, and Levis are those most commonly in use. Apply extension to hand and counter-extension to arm. Barton's dressing consists of a long anterior and posterior splint, two wedges, a roller, and a sling. Place the arm between pronation and supination; make traction; place the anterior wedge with its base toward the fingers, and the posterior wedge with its apex toward the fingers; then put the arm in a sling.

Bond's splint is a block on a slightly pistol-shaped splint. This splint keeps the hand in its natural position; a little extended, with fingers flexed.

Levis's splint is made of copper; is applied to the anterior surface of the hand and arm, with the hand slightly flexed. *Passive motion*, commenced as soon as the swelling subsides, must be persistently employed. Begin by moving the fingers. Carefully remove the splint; move each joint separately from the ends of the fingers to the wrist, always holding the fragments steady; also move the elbow and shoulder. The dressings should be reapplied the day following the primary dressing, but need to be repeated only every second day for the first week. Dressing must be retained for four or five weeks.

FIG. 65



Colles' Fracture.

FRACTURES OF THE CARPUS, ETC.

The bones of the carpus, when broken, are usually crushed by heavy bodies, or broken by direct violence; they are generally followed by severe and troublesome symptoms.

FRACTURES OF THE METACARPAL BONES,

or of the phalanges, are readily recognized.

For fractures of the carpus and middle metacarpal bones, it is a good plan to make the patient grasp some soft substance and bind his hand over it; for fractures of the lateral metacarpal bones, it is well to support the hand on a well-padded splint.

If necessary, apply cooling lotions.

FRACTURES OF THE PELVIS.

Fracture of the pelvis is usually the result of direct violence. A heavy fall, a cart-wheel passing over the pelvis, a squeeze between the buffers of two railway cars, and such similar accidents. It may, of course, result from gun-shot wounds or from indirect violence, as when a person falls from a height and alights on his feet.

The symptoms are inability to walk, though the patient may be able to move his limbs in bed; mobility and crepitus, obtained by pressing on both crests of the ilium; pain on moving or coughing; displacement which may be recognized by external examination, per rectum, or per vaginam.

Inability to empty the bladder or voiding of bloody urine denotes some injury of this organ.

Fracture of the acetabulum is indicated by the crepitus elicited on rotating the femur with one hand placed over the trochanter.

Separation of the symphyses, or of the *sacro-iliac articulation*, is recognized by the free mobility of the part, and at the same time an interval may be felt in the situation of the separation. The pelvic viscera are frequently injured in this fracture; rupture of the bladder or urethra, giving rise to extravasation of urine, laceration of the rectum, or of the larger blood-vessels, may occur.

Usually the *rami* of the pubes and ischium are the seats of fracture; the line of fracture may pass above the acetabulum in various directions, or it may involve the acetabulum, fissuring its floor or fracturing its margin. The acetabulum may be comminuted, and the head of the femur driven into the pelvic cavity. Any portion of these bones may be broken, including the crest of the ilium or the tuberosity of the ischium, and not unfrequently both innominate bones.

Treatment.—Absolute rest of from six weeks to two months is essential. The pelvis must be bound around with *a broad roller* and the patient laid to rest on a *flat bed* or mattress. The thighs must be flexed upon the abdomen and supplied with pillows under the knees.

Fracture of the *acetabulum* must be treated by means of a long splint, or hip splint of gutta-percha, moulded to the side of the pelvis and thigh, so as to fix the joint. A catheter, to ascertain the state of the bladder, should be introduced. If bloody urine, or other symptom of injury to this organ or to the urethra be present, the catheter must be kept in the bladder, to prevent extravasation.

If rupture of the bladder has occurred in the part uncovered by peritoneum, *as the anterior wall or* base of the organ, the urine will find its way into the connective tissue between the peritoneum and abdominal wall, producing sloughing; it may burst into the peritoneum and reach the subcutaneous connective tissue, or pass through the pelvic foramen into the scrotum and thighs. An open wound of the bladder is not as dangerous as a laceration.

The symptoms of rupture of the bladder are collapse, violent burning pain in the hypogastric region; a constant and incessant desire to urinate, with inability to pass any water. A small quantity of blood may flow from the urethra. The patient is unable to stand or walk. On passing the catheter the bladder will be found empty. Urgent tenesmus and peritonitis soon set in. If the rupture is extra-peritoneal the symptoms are those of extravasation of urine. There will be a characteristically *bounded swelling*, with increasing size and extent; the scrotum and penis becoming enormously distended; a sensation of *sudden relief* of the distended bladder is immediately followed by an *acute burning* sensation in the peritoneum. *Gangrenous inflammation* of the cellular texture soon supervenes, the skin assumes a dusky red hue, purplish or black gangrenous spots appear. Ultimately sloughing of the skin and cellular texture of the scrotum exposes the testicles.

The urethra may burst in *front* of the *bulb*, when the urine infiltrates into the *corpus spongiosum*, which is followed by gangrene. The *constitutional* disturbance is that of low typhoid depression; a rapid, feeble pulse, dry, brown or black tongue, and muttering delirium as death approaches.

Treatment.—When the laceration is *intra-peritoneal* laparotomy should be performed, the peritoneal cavity carefully cleaned of blood and urine; the rectum must then be distended with a rectal bag, and the rupture carefully stitched with silk sutures. Lateral cystotomy is then performed, to secure an exit for the urine. If *extra-peritoneal*, and extravasation can be made out by external examination, free incisions, both supra-pubic and perineal, must be made, followed by median and lateral cystotomy. The constitutional treatment should be supporting and opiates should be freely administered.

FRACTURES OF THE THIGH.

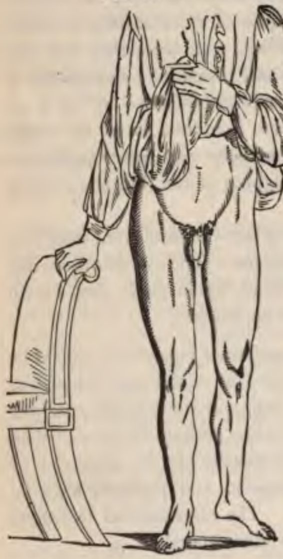
1. FRACTURE OF THE NECK OF THE FEMUR WITHIN THE CAPSULE.

It is rare in persons under fifty, and generally occurs in old persons, especially women.

Symptoms.—After a fall or blow, the patient is unable to stand; there is great pain, principally at upper and inner part of the thigh, increased by motion. The leg is *shorter*, *the foot* turned outward, rarely inward; the heel rests in the interval between the ankle and tendo-Achillis; when the limb is drawn to proper length and rotated, crepitus may be detected. When extension is discontinued, the limb again shortens. The limb may be freely moved by the surgeon, but the patient cannot move it from the bed.

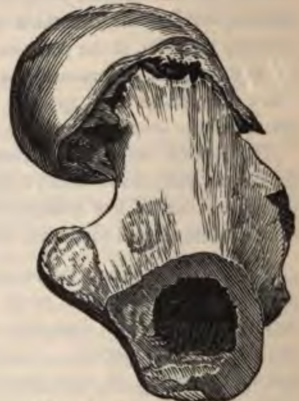
Dr. Allis was the first to point out the fact that in all fractures situated above the insertion of the tensor vagina femoris, but especially in those occurring within the capsular ligament, the fascia lata is relaxed to such an extent as to make its want of tension of strong diagnostic value.

FIG. 66



Fracture of Neck of Femur.

FIG. 67.



Fracture Within the Capsule.

If the fibrous investment of the neck be not torn, or if the fracture be very oblique, so that the upper opposes the ascent of the lower fragment, there will be little or no shortening.

This fracture does not unite by bone, unless the broken surfaces are held close *together by the untorn* periosteum or by impaction. Generally it does not unite *at all.*

Treatment.—If the patient is old and feeble, he should be kept in bed for a fortnight, till pain and tenderness abate, with a heavy sand-bag on each side of the limb, and a bag of shot or sand attached to the foot or ankle, which should be allowed to hang over the bed. He then may be allowed to sit in a high chair, and shortly begin the use of crutches.

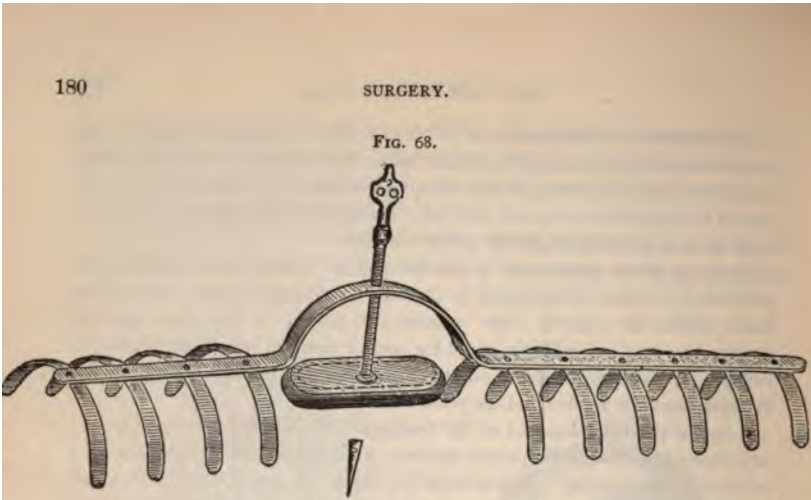
Professor Senn claims that by his method of "immediate reduction and permanent fixation," bony union is obtained in fractures of the neck of the femur within the capsule. He "places the patient in the erect position, causing him to stand with his sound leg upon a stool or box about two feet in height; in this position he is supported by a person on each side until the dressing has been applied and the plaster is set.

"Another person takes care of the fractured limb, which is gently supported and immovably held, in impacted fractures, until permanent fixation has been secured by the dressing. In non-impacted fractures the weight of the fractured limb makes auto-extension, which is often quite sufficient to restore the normal length of the limb; if this is not the case, the person who has charge of the limb makes traction until all shortening has been overcome as far as possible, at the same time holding the limb in position, so that the great toe is on a straight line with the inner margin of the patella and the anterior superior spinous process of the ilium. In applying the plaster-of-Paris bandage over the seat of fracture a fenestrum corresponding in size to the dimensions of the compress with which the lateral pressure is to be made is left open over the great trochanter.

"To secure perfect immobility at the seat of fractures, it is not only necessary to include in the dressing the fractured limb and the entire pelvis, but it is absolutely necessary to include the opposite limb as far as the knee, and to extend the dressing as far as the cartilage of the eighth rib. The splint, which is represented by Figure 68, is incorporated in the plaster-of-Paris dressing, and must be carefully applied, so that the compress, composed of a well-cushioned pad with a stiff, unyielding back, rests directly upon the trochanter major, and the pressure, which is made by a set-screw, is directed in the axis of the femoral neck. Lateral pressure is not applied until the plaster has completely set. Syncope should be guarded against by the administration of stimulants. As soon as the plaster has sufficiently hardened to retain the limb in proper position, the patient should be laid upon a smooth, even mattress, without pillows under the head, and in non-impacted fractures the foot is held in a straight position, and extension is kept up until lateral pressure can be applied.

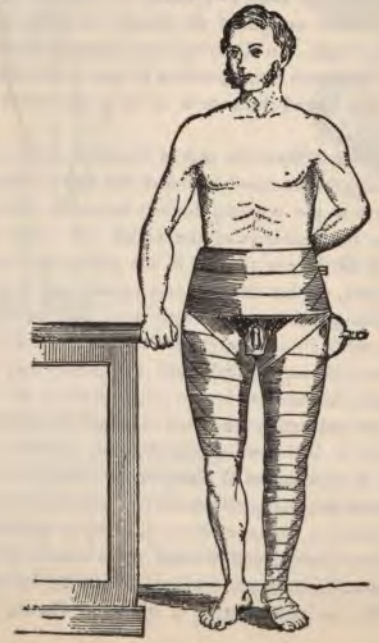
"No matter how snugly a plaster-of-Paris dressing is applied, as the result of shrinkage it becomes loose, and without some means of making lateral pressure it would become necessary to change it from time to time, in order to render *it efficient. But* by incorporating a splint, as shown in Figure 68, in

FIG. 68.



Senn's Apparatus for Treating Fracture of Neck of Femur.

FIG. 69.



the plaster dressing (Figure 69) this is obviated, and the lateral pressure is regulated, day by day, by moving the screw, the proximal end of which rests on an oval depression in the centre of the pad."

FRACTURE EXTERNAL TO THE CAPSULAR LIGAMENT.

It is caused by direct violence, and in consequence of other injuries around the great trochanter, or of the cervix being firmly impacted; the diagnosis is very difficult; there is no crepitus; the limb is shortened, but cannot be brought to its natural length by any justifiable amount of tension.

Treatment.—It is treated by extension and counter-extension, just as in fracture of the shaft of the bone.

FRACTURE JUST BELOW THE TROCHANTERS.

The upper fragment is tilted forward by the psoas magnus and iliacus.

Treatment.—Extension is made by the action of a weight and pulley, and counter-extension by elevation of the foot of the bed. The limb is kept at rest between two sand-bags, and the dressing is completed by fastening a broad binder around the pelvis.

FRACTURE OF THE SHAFT OF THE FEMUR.

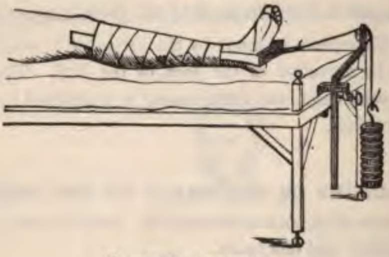
The symptoms are plain and unmistakable; there is pain, swelling, crepitus, preternatural mobility, and deformity.

Treatment of Fractures of the Upper Third.—The lower fragment must be brought to the upper; the thigh must be flexed. Professor Nathan R. Smith's splint is generally recommended. It is an anterior wire splint from which the leg is suspended. First make a double inclined plane with pillows so adjusted that the fragments will fall into place; lay five or six strips across the pillow to fasten around the splint after complete coaptation of the parts has been made. The splint is bent at the knee and turned up at each extremity to accommodate the flexions of the ankle and groin. Apply a roller around the limb and splint to support the strips and a few spicas to fix the splint at the groin. Suspend the limb and then remove the pillows. Professor Agnew's apparatus for fracture of the upper third of the femur "consists of a double inclined plane with hinged sides attached to the thigh-piece; upon this the limb is deposited, a pillow being interposed between the thigh and the splint and a soft pad placed beneath the leg; an adhesive strip is next attached to the sides of the thigh, extending up as far as the upper end of the lower fragment, and with a loop below, into which is to be fastened a piece of light wood, as in the ordinary fracture dressing. To this piece of wood a cord is attached, which is to be carried over a pulley set in an upright board that is to be screwed to the foot of the bed. To this cord the extending weights are attached. Lateral pressure is applied to the thigh by bringing up the sides of the femoral part of the plane and securing them by strips of muslin while the leg is retained in position by turns of the roller."*

Treatment of Fracture of the Shaft Below the Upper Third.—The method is now generally pursued of extension by the action of a weight and pulley, and counter-extension is made by elevation of the foot of the bed.

A strip of adhesive plaster from two and a half to three inches in width is stretched along on each side of the limb to a short distance below the seat of fracture, and confined with a roller extended from the toes up to the groin, the middle of the plaster forming a loop below the sole of the foot. A thin block of wood, the width of the plaster and long enough to prevent pressure over the ankle, is inserted into the loop, and serves to receive the extending cord, which is fastened to an elastic rubber band passing around the block and playing over the footboard, or over a temporary frame, perforated at a height of about four inches above the level of the mattress, or an adjustable clamp may be used, holding in position the rod which supports the pulley. (Fig. 70.) The thigh, at the seat of the fracture, is surrounded with short splints, and a bandage is applied from the toes to the groin; the heel is supported upon a thin, wedge-shaped hair cushion; a bag filled with sand is placed along the outer and another on the inner aspect of the thigh and leg to prevent motion. The amount of weight employed must be determined by the age of the patient

FIG. 70.



Extension Apparatus.

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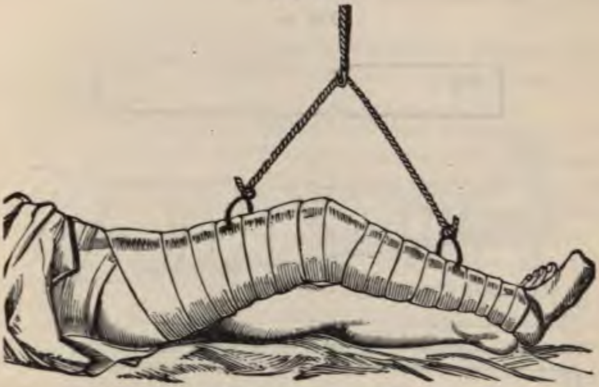
* "Agnew's Surgery," Vol. 1, p. 957.

and other circumstances of the case. An adult will require from ten to twelve pounds; a child under eight years of age will require about six pounds.

Liston's long splint; that of Desault, modified and improved by Physic; N. R. Smith's anterior splint, which is especially adapted to cases where the upper third of the bone tends to tilt forward; Hodgen's suspension apparatus; Levis's extending apparatus; Dr. Buck's apparatus; and that of Morton, which is in use in the Pennsylvania Hospital, are all in vogue with the profession, and each has its advocates.

FIG 71.



N. R. Smith's Anterior Splint.

FRACTURE OF THE FEMUR IN CHILDREN.

These fractures heal readily and are rarely followed by an appreciable shortening.

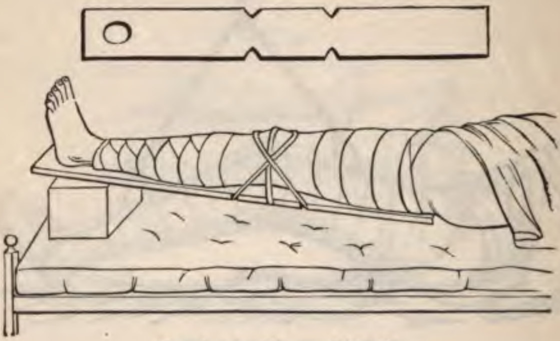
Treatment.—When the limb has been adjusted and drawn to its proper length a plain roller is to be applied, beginning at the foot, and ending at the groin with a spica; a sufficient quantity of cotton wadding to prevent irritation having been placed at the ankle, the knee, and the crest of the ilium, a long splint is laid along the outer side of the body, extending from the axilla to three or four inches below the foot, and is to be bound in this position by plaster rollers, likewise commencing at the foot and ending with a spica at the groin.

The upper part of the splint is to be secured to the trunk by a roller. Silicate of soda or starch may be used instead of plaster; when the former is employed, three or four strips of pasteboard should be laid around the seat of fracture, secured by a roller, to which the silicate of soda is to be likewise applied.

FRACTURES OF THE PATELLA.

The patella may be fractured longitudinally, but is usually broken transversely.

FIG. 72.



Dressing for Fractured Patella.

In longitudinal fracture, the treatment is to reduce the inflammation by leeches and evaporating lotions, and then apply a roller, and afterward a laced cap, with a strap to buckle above and below the knee; the union, as a rule, will be ligamentous.

Transverse Fracture.—The upper fragment is drawn upward by the action of the muscles inserted into it, while the lower part remains stationary. The injury is known by the depression between the two portions of bone; the power of extending the limb is lost and the knee bends forward. The union of the fracture is generally by ligament.

The treatment indicated is to keep the leg steadily extended, the thigh at *the same time* flexed upon the pelvis, and the body kept in the semi-erect posture; a strong and well-padded tin or wire case may be used, reaching from the middle of the thigh to the corresponding point of the leg. Prof. Brinton prefers to use a posterior splint, reaching from the heel to the gluteal fold, a roller having been previously applied from the toes upward, and another from the groin downward. The fragments, having been brought in apposition, are confined by numerous adhesive strips, carried around the bone above and below the joint, and afterward connected by vertical and transverse pieces. The splint should be kept applied for six or eight weeks; at the end of this period it may be left off, and the patient be allowed to get about on crutches, wearing a stiff bandage to prevent any flexion of the joint. Manning's splint, the splint of Agnew and of Hamilton, Malgaigne's hooks, Levis's hooks, and the hooks of Morton, each has its advocates.

Laying open the joints and wiring the fragments is recommended by Sir Joseph Lister, and has been resorted to in a large number of cases with comparative success.

To perform this operation, a longitudinal incision is made over the centre of the joint, which is opened, and the fragments of the patella are exposed; any blood clot which is present in the joint, or between the fragments, is turned out, and the fragments themselves are cleared of any aponeurotic and fibrous tissue which may be found lying between and over their broken surfaces. Each fragment is then bored obliquely with a drill, taking care not to reach its cartilaginous surface. Sutures of silver wire or of heavy catgut are then passed through the drilled holes, and the fragments having been drawn together, the ends of the wire are twisted, out short, and then hammered down on the bone, where they may be allowed to remain permanently, without causing any irritation. This operation, if performed, must always be carried on under the most careful antiseptic precautions; free drainage must be provided for by the insertion of tubes in openings made at the back of the joint on either side.

It is proper to observe that wiring the fragments has, in several cases, been followed by suppuration in the joint, and as a consequence the limb, and even the patient's life, has been lost.

Kocher's method of treating fractured patella consists in passing a stout silver wire completely around the bone. A needle in a handle is passed through the ligamentum patellæ, through the tendon of the quadriceps, and out through the skin. It is then threaded and drawn back again; the broken fragments are drawn together, the wire twisted up over something, to protect the skin, and the openings dusted over with iodoform. The limb is then placed upon a back splint, bandaged, and kept in this position for three weeks; at the end of this time the wire is cut, drawn out of the wound, and the sore points that are left dusted with iodoform until the parts are healed.

For the first few days after the injury is incurred, antiphlogistic measures are to be employed, before any permanent treatment is to be resorted to.

FRACTURES OF THE LEG.

The two bones may be broken together, or they may be broken separately. The commonest fracture of the tibia is in the lower third; it is most frequently oblique, with the upper end directed downward and forward, so that it rides over the lower fragment; the fibula may give way at the same time, at a point nearly opposite. The tibia may also be broken transversely, at either the upper or lower half.

The fibula is less frequently broken than the tibia. Both bones are seldom broken at the same level, unless by direct violence. The tibia is weakest at its lower extremity and the fibula at the upper part.

Fracture of the lower end of the fibula, accompanied by dislocation outward of the foot, at the ankle joint, is known as **Pott's fracture.**

The bone is broken from two to four inches above its lower extremity, the ends of the fragment being driven inward. The signs of this injury are a well marked depression at the seat of the fracture; the foot is twisted outward and the sole everted by the peronei; the inner malleolus is unbroken, projects prominently beneath the skin. If separated, the detached fragment can be readily felt. Crepitus may be readily obtained. The heel is drawn upward.

There are many methods of treatment: By the common splints: first reduce the fracture; apply the many-tailed bandage, and then use the shaped splints of Cline, supported by sand-bags, or apply Macintyre's splint or Boyer's board and pillow dressing. The fracture box; the stiffened bandage, using the silicate of potash, paper and paste; plaster-of-Paris; or chalk and gum bandage, are in general use and commended in turn.

In Pott's fracture *Dupuytren's splint* is generally recommended; it is a straight wooden splint, notched at its lower end, and reaching from the head of the tibia to about four inches below the sole of the foot. It is applied to the inner aspect of the leg; a thick pad, extending to the inner malleolus, must be interposed between the splint and the leg. The upper end of the splint is to be bandaged to the limb. The foot is drawn across the lower part of the splint, the thick pad acting as a fulcrum, and the foot is fastened to the splint by a figure-of-8 bandage, carried around the ankle and foot and through the notches at its lower end.

Boyer's dressing consists of two splints, a pillow, a splint cloth, and three *strips. The splints should* extend from above the knee to below the foot; they must be wrapped in the splint cloth, a bandage applied around the foot to keep it everted and set in the natural position; the finger should be run along the spine of the tibia, to see if the fragments are in position, when the splints should be applied and kept in place by the strips, the fractured limb resting on the pillow between the splints.

The fracture box consists of two sides attached to a base, with a fenestrated foot-board. A pillow is to be placed in the box and the foot is to be affixed to the foot-board. The heel must be protected by a ring of oakum, and is not to touch the foot-board. The fragments are then to be adjusted and the sides of the board brought up and tied together with strips. The box should be swung.

FRACTURES OF THE FOOT.

These fractures are of rare occurrence, and result from severe crushes, and usually several bones are involved in the injury. The fracture is generally compound.

The *os calcis* is sometimes fractured as the result of a fall upon the heel.

If the bone be fractured in front of the ligaments there is but slight displacement; there will be crepitus on making lateral movements and grasping the heel; there will also be flattening, pain, and swelling.

Should the posterior part be separated behind the attachment of the interosseous ligament, the fragment is drawn up by the muscles of the calf and projected posteriorly. Crepitus can be obtained by bringing the fractured extremities in apposition.

Fractures of the *metatarsal* bones and *phalanges* are always the result of direct violence.

Treatment.—When the posterior portion of the os calcis is separated and drawn away by the muscles of the calf, the latter should be relaxed and the fragments brought into apposition by placing the limb on an outside splint, with the knee flexed and the foot extended. The apparatus used for rupture of the *tendo-Achillis* will often answer the indications. In fracture of any of the other bones of the foot, it should be kept at rest, either on a back splint with a foot-piece, or by means of some form of stiff bandage. In all forms of fractures of the tarsal bones timely motion should be employed to prevent ankylosis.

TREATMENT OF COMPOUND FRACTURES.

If the limb is put in a stiff bandage, an opening must be cut over the seat of fracture, in order to allow of the wound being examined and dressed when necessary.

If there is a mere puncture of the skin, caused by one of the sharp ends of the fragments, it should be treated antiseptically and closed at once, by applying a pad of cotton dipped in iodoform and collodion. If under this treatment the temperature rises and the parts become hot, red, painful, and swollen, the pad should be removed, and if there be evidence of suppuration, the wound must be opened, the parts carefully cleansed, and thoroughly syringed out with an antiseptic lotion.

If the wound is of a larger size, its edges lacerated, tissues bruised and swollen, it should not be closed at once. A tourniquet should be applied, and bichloride towels placed under the part, which should then be shaved. Any remaining soap must be washed away with 1–1000 bichloride solution, and the surface scrubbed with a nail brush.

Be sure to place carbolized towels wherever instruments may possibly be laid, or wherever the operation may extend.

Freely enlarge the wound, if necessary, and constantly irrigate with 1–2000 bichloride solution.

Trim away all muscular and other soft tissues which are injured to such an extent that they cannot live; remove loose fragments and rough margins of bones, and shape the ends so that they will fit each other; then drill holes into them so that they can be fastened together with prepared catgut, silver wire, or silkworm gut, and be careful not to irritate the parts with the ends of sutures, which are not to be removed.

The muscular tissue is to be united or approximated by catgut sutures.

The ends of large nerves that are divided must be carefully trimmed, and brought together with fine catgut sutures.

Bleeding vessels are to be tied with catgut ligatures.

When hemorrhage is controlled, put in the wound a drainage tube of large calibre, making a free counter-opening if necessary.

Finally wash out the parts with 1–1000 bichloride solution, and bring together the margins of the wound with catgut sutures.

Powder sterilized iodoform over the wound. Put Lister's protective over the line of sutures, and cover the wound with a sufficient quantity of bichloride gauze; fasten it in its place with a bichloride gauze bandage. Wind five yards of bichloride gauze around the limb; keep this in place with a bandage of the same material, cover this with bichloride cotton two inches in thickness, envelope the whole in rubber dam. Then apply an ordinary roller bandage, and finish the dressing with a plaster-of-Paris splint. Sling the limb to a bar above the bed.

Change the dressings in a week, so that the drainage tube may be removed, and put in its place an absorbable bone drain, using at the same time bichloride irrigation.

Sprinkle iodoform about the wound, and dress as heretofore directed.

The limb will probably not require to be again dressed for six weeks.

Hot and cold douche, massage, and passive motion will be required after removing the final dressings.

Amputation may be necessary where there is extensive destruction and laceration of the soft parts, with much splintering of the bone, especially if the main vessels of the limb are wounded, or an adjacent joint laid open.

During the treatment, many complications may arise, such as *œdema* and *swelling* of the limb, *ulceration* and *sloughing*, *spasms* of the muscles, *gangrene*, and venous thrombosis.

When œdema presents itself, the bandages should be slackened, and an evaporating lotion applied; if the tissues are bruised, paint the parts with tinct. benz. comp.; should bullæ form, they may be pricked, and their contents allowed to escape.

Ulcers are apt to form over bony prominences, and *bedsores* may appear over the sacrum, buttocks, hips, etc. These must be treated antiseptically.

Gangrene, as a rule, is the result of tight bandaging or other improper treatment. The part should be frequently examined, and if there be coldness, numbness, lividity or swelling of the limb, the bandages should be at once relaxed.

SPRAINS.

A Sprain is a violent stretching of the ligaments, tendons, or fascia surrounding a joint, with or without rupture of some of their fibres and blood-vessels.

It usually happens from the sudden extension of the joint in the direction for which the muscles are unprepared; the most common situations of these accidents are the wrist or ankle.

The pain produced is instant and severe, frequently attended with faintness; the parts begin to swell immediately, and there is great tumefaction and ecchymosis, and subsequently weakness and stiffness of the part. There is inability to bear any weight on the limb, and any attempt to move the joint surfaces on each other is attended with increased pain.

The remote effects of this lesion are often permanent pain and weakness; or stiffness and even ankylosis.

Treatment.—The patient should at once go to bed, so as to ensure perfect rest; the part affected should be confined to a splint behind, held in place by a comfortably applied bandage, and the position of the limb should always be such as to relax the muscles. Immerse the limb in water of a temperature as hot as the patient can bear, and let it remain there for at least half an hour; acetate of lead and opium should then be applied through the medium of wet rags. If the strain be complicated with laceration of ligaments, apply a splint of silicate of soda as soon as the inflammation has subsided.

Should the pain and tumefaction increase, leeches should be freely applied, and if the patient is very plethoric, and the injury extensive, purgatives and general bleeding must be had recourse to.

Care should be taken not to use the part too early.

Should the disease become chronic, friction with moderate pressure should be used; stimulating liniments should be rubbed over the parts, which should be kept neatly bandaged; leeches and blisters should be resorted to, and good effects are often produced by pouring a continued stream of cold water over the part.

SYNOVITIS.

Synovitis, or acute inflammation of the synovial membrane, may be produced by local or constitutional causes, such as blows, strains, mechanical injuries, penetrating wounds, exposure to cold, syphilitic or gonorrhœal poisons, and gout.

The knee is the joint most frequently affected.

Symptoms.—Severe aching pain in the joint, increased by motion, great swelling, redness of the surface, tenderness and fever, which is frequently violent.

The swelling, which is occasioned by a rapid effusion of fluid into the synovial cavity, is distinctive. There is evident fluctuation, if the joint is superficial. The shape of the joint is always altered.

When the knee is affected the patella is pushed forward, and there is great fullness on each side of it, and at the lower and front part of the thigh. The swelling, if at the elbow, is most distinct above and between the olecranon and the condyle; and in the hip there is general fullness of the surrounding parts, and tenderness on pressure.

***Treatment.**—Limb* must be kept absolutely motionless. A splint must be *pplied, after being padded,* so that it may be fastened some distance above and below the joint, and care must be taken that it does not touch the affected part. Leeches to the joint, cups in the neighborhood, evaporating lotions or hot fomentations. Calomel purgatives should be administered; and opiates, to relieve pain. When there is a tendency to the disease becoming chronic iodide of potassium should be administered. And if the disease be connected with rheumatism, ammonia and potash should be prescribed. Where there is a tendency to gout, colchicum with potash is to be employed. In syphilitic cases, mercury, in its different forms, is most to be relied upon.

COXALGIA, OR TUBERCULOUS DISEASE OF THE HIP JOINT.

This disease is most frequent from the third to the seventh year.

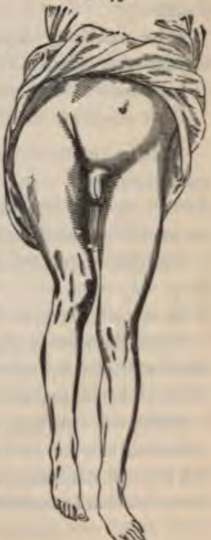
The first circumstance which indicates disease of this joint is some degree of lameness and pain in the knee, with more or less weariness, some eversion of the foot and dragging of the leg. The motions of the joints are impeded; extension is performed with difficulty; the knee is bent; the heel on the diseased side scarcely rests on the ground; there is great difficulty experienced in the flexion of the joint.

To ascertain whether disease exists, the patient is placed on his back and examined, to ascertain whether the sides of the pelvis are equal; the pelvis will be lower on the diseased side. Then bend the knee on the abdomen; if there be disease of the hip joint, considerable pain will be occasioned. In rotating the joint pain will be excited. If the patient is turned on his face the nates on the affected side will be found lower.

If the surgeon presses on the hip joint, either in front, over the psoas and iliacus, or behind the great trochanter, or jerks the femur against the acetabulum by a sharp tap on the trochanter major or heel, pain will be felt in the hip, and that in the knee will be greatly aggravated.

Abscesses are frequently formed in this disease, which take various directions; as a rule, their course is down the thigh, where they break; they may, however, occur in the upper part of the thigh, the rectum or vagina.

FIG. 73.



Coxalgia.

The pain of *complete* extension of the joint, and the instinctive resistance of the patient to this position, when laid on a flat, hard bed, producing, when the knee is pressed straight, a sudden aching of the lumbar curve, is very characteristic of the disease, even in the earliest stages.

Treatment.—The patient must be kept in perfect rest in the straight posture, by means of sand-bags placed on each side of the limb; that on the outside reaching as far as the axilla.

If an abscess form, open the part at once and drain it thoroughly. Excision of the head of the femur may become necessary.

Extension and counter-extension must be strictly kept up, in the same manner as in treatment of fractures of the lower extremities.

Dr. Buck's American stirrup may be used with advantage.

When the patient is in a condition to take exercise in the open air, the apparatus of Dr. Sayre answers all the indications.

ANKYLOSIS.

Ankylosis is an osseous or ligamentous union of the joint ends of bones, impeding or promoting motion; it frequently follows injuries or disease of the joints.

False ankylosis depends on the thickening of the synovial membrane, or organization of bands of adhesion within and around the joint.

Ligamentous ankylosis is the union of two articular surfaces by fibrous tissue.

Bony ankylosis results where the fibrous tissue becomes ossified.

Treatment should not be attempted until the diseased action has ceased and parts return to a quiescent condition. After this, *passive motion*, combined with friction, may be resorted to. A screw fitted to a splint with a hinge in it may be used to gradually straighten the joint.

Forcible or immediate extension, by breaking up ligamentous adhesions, is frequently employed; and any tendons, fascia or muscular fibres whose rigidity is an obstacle, may be divided by subcutaneous section.

When the knee is affected, the hamstring muscles and portions of the fascia may be divided; if the elbow, the biceps may be cut. The joint should then be extended by main force.

When the ankylosis is bony and the *limb fixed in position*, a subcutaneous operation may be performed; when it is *bony and extensive*, the remedy is to cut through the bone, or cut out a wedge-shaped portion, and then employ sufficient motion to establish a false joint.

CARIES.

Caries is a disease of the bones supposed to be analogous to ulceration of the soft parts.

Bones of a spongy texture are more frequently attacked by caries than such as are compact; hence the vertebræ, astragalus and other bones of the tarsus, those of the carpus, the sternum, the pelvis, and the heads of the long bones, are often affected; the bones of young persons are more frequently the seat of caries than those of old subjects.

On examination, the bone is found to be soft and dark red; its cells are filled with a reddish, serous, glairy fluid, or with soft granulations of feeble vitality. After a time suppuration occurs between it and the surface, the abscess breaks, and the carious portion of the bone, already softened, gradually perishes in minute particles, which are thrown off and discharged with the pus. The bone appears enlarged, and one or more sinuses open, at points that are soft and sunken.

The predisposing cause is some constitutional disorder, scrofula, or syphilis. The exciting cause may be a blow or injury.

Treatment.—Rectify constitutional disorder and remove local disease. Change of air, tonics, sea air, sea bathing, and the usual remedies employed in scrofula and syphilis are indicated.

Locally, the best treatment is to freely expose and remove the diseased portion of bone.

NECROSIS.

Necrosis is the death or mortification of a bone, and is applied to cases in which part of the shaft of a bone dies, from injury or violent inflammation. The term exfoliation signifies necrosis of a thin, superficial layer, which is not encased in new bone.

This disease most frequently attacks bones of compact tissue; the shafts of the femur and tibia are often the seat of this affection. Necrosis of the lower jaw frequently results from the inhalation of the fumes of phosphorus by persons employed in lucifer match factories; this causes inflammation and thickening of the periosteum, followed by abscess, resulting in necrosis of a portion of the bone.

The bone, in necrosis, dies, from obstruction of its circulation; but the periosteum, with the articular extremities, its medullary membrane, and other contiguous parts, speedily ossify and form a new shell around the dead portion, and adhere to the living bone above and below.

Symptoms.—After acute inflammation, the bone remains permanently swelled, and the apertures made for the discharge of matter remain as sinuses; these sinuous apertures in the skin usually correspond to holes in the shell of the new bone, and by passing a probe through them, the sequestrum may be felt, loose, in the interior.

Treatment.—The indication is to remove the sequestrum, as soon as it is sufficiently loose. If small, it may be grasped and removed with a forceps; if larger, a free incision should be made, so as to expose the surface of the bone, and it should be made at a point where the *cloacæ* exist, or where the bone is nearest the skin. The new shell must be perforated with either a Hey's saw, or with a chisel or gouge, and the sequestrum drawn out. The wound may be filled with defalcified bone chips, as recommended by Senn. (See Formula, No. 88, at end of this volume.)

RICKETS, OR RACHITIS.

This is a peculiar disease, produced by a morbid condition of the whole body, and generally arising from hereditary taint, defective hygienic conditions, want of fresh air and light. It is frequently attended with scrofulous disease. Its leading characteristic is imperfect development, atrophy and distortion of some of the bones of the body; these are soft, and consist of a sort of semi-cartilaginous tissue, which will bend without breaking. The articular portions are often disproportionately large. The shafts are unable to support the weight of the body without bending.

The physiognomy and general appearance are very peculiar; the stature is stunted, the head large, and the forehead protuberant. The face is small and triangular, chin sharp, teeth projecting, chest prominent and narrow, the spine variously curved; the pelvis small; the promonotory of the sacrum and acetabulum pressed together; the limbs crooked, their natural curves increased.

Treatment.—Invigorate the constitution, if possible.

Cod-liver oil, iron, compound syrup of the hypophosphite of lime, soda, potash and iron, and such other remedies as are usually prescribed for scrofula.

Diet should be generous and nutritious; animal food, milk, eggs, etc., etc. Sunlight and pure air.

If possible, use some mechanical contrivance to straighten the bones, and keep them in that condition until they are strong enough to bear the weight of the body.

If necessary, perform some one of the numerous operations recommended by *surgical authorities to* suit the cases as they present themselves.

DISEASES OF THE SPINE.

PSOAS AND LUMBAR ABSCESS.

These are chronic collections of tubercular fluid, which form in the cellular substance of the loins, behind the peritoneum, and descend in the course of the psoas muscle; if the disease forms on the side of the vertebræ, instead of the fore part, it is termed lumbar abscess.

At the beginning there is little or no pain, no inflammation, nor is there febrile disturbance; but previous to the appearance of any other symptom the patient has an unaccountable feeling of weakness across the loins, accompanied by pains, usually giving no indication of the seat of the disease, and likely to be regarded as rheumatic.

The tubercular fluid is formed slowly and imperceptibly, and occasions, at first, no manifest swelling, nor fluctuation.

When the lower dorsal or upper lumbar vertebræ are diseased, the pus enters the sheath of the psoas, or the substance of the muscle, and is firmly bound down in front by the fascia covering this muscle and the iliacus.

The abscess proceeds as far as the tendon of the muscle by Poupart's ligament, when its further progress is apt to be arrested. When it has attained considerable magnitude it passes under Poupart's ligament, between the femoral vein and the symphysis pubis.

The diagnosis is difficult when the abscess is unattended by an external tumor.

The swelling takes place in various situations and assumes different aspects; it may appear beneath the femoral fascia, or it may descend as far as the knee and form a prominent swelling; sometimes it will make its way downward into the pelvis and occasion a swelling in the neighborhood of the anus, or it may appear in the vicinity of the vertebræ, or, again, it may make its way through the abdominal muscles.

This disease arises generally from cold, strains, or falls, and from general debility, and not unfrequently from spinal affections.

Treatment.—A psoas abscess should be opened, if possible, before it leaves the abdomen, just above Poupart's ligament, external to the line of the vessels. If it points at the inner side of the thigh, an incision may be made also in that situation, in addition to the one above Poupart's ligament. Under antiseptic precautions, the sooner the abscess is opened the better, for the abscess cavity is then smaller than if the surgeon waits till the fluid has burrowed its way into the thigh. Free drainage should be established from the groin to the lumbar region.

The *same principle* of treatment must be applied to lumbar abscesses.

Antiseptic dressings must be continued as long as there is any discharge. The general treatment must be tonic and alterative.

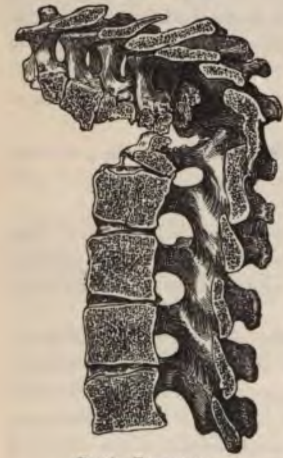
LATERAL CURVATURE OF THE SPINE

arises from debility of the ligaments and muscles, and is common among girls between the age of ten and sixteen years.

There is a perceptible *growing out of* one shoulder, or an elevation of one shoulder, more frequently the right; the spine is found, on examination, to be curved like an S and twisted on its long axis.

This deformity is usually produced by occupations that tax one side of the body more than the other, especially the habit of *standing at ease* on the right leg; it may also be produced by one-sided postures in sitting or writing. This curvature is frequently produced by disease of the bones, as in rickets.

FIG. 74.



Pott's Curvature.

Treatment.—The general health of the patient is the first thing to be attended to; change of air, good diet, the different preparations of iron, bathing the body with salt and water every morning, are the remedies to be resorted to.

The patient should be kept out of doors as much as possible, and should be directed to take foot or horse exercise, but when not moving he should be required to lie down as much as possible, and not to sit upright. Mechanical support may be advisable in severe cases.

ANGULAR CURVATURE,

known as *Pott's Curvature*, is produced by softening and absorption of the intervertebral substances, and caries of the bodies of the vertebræ.

Symptoms.—This disease usually begins with weakness, coldness, and numbness of the legs, and incapability of making exertion; these symptoms are followed by twitchings and spasms of the legs, and sometimes palsy. In adults, there is generally a dull, aching pain, aggravated by motion, and *tenderness on pressure*. If the patient slips when walking, he experiences *great distress*; this is one of the symptoms in children by which attention is called to their condition. If the disease is situated in the dorsal vertebræ, there will be tightness of the chest and difficulty of breathing; if the cervical vertebræ are affected, one or both arms may be palsied, and there will be difficulty in supporting the head. As the disease advances, the trunk becomes curved forward, and the spinous processes of the diseased vertebræ project backward. Abscesses may form; there is great constitutional derangement, with hectic.

Treatment.—Rest in the horizontal posture is absolutely necessary. A bandage containing strips of whalebone, and reaching from the head to the hips, may be employed to keep the trunk at rest. Issues on each side of the spinous process of the diseased vertebræ may be used.

The constitutional treatment should be the same as that recommended for angular curvature, and for scrofulous cases generally.

Efficient mechanical support during convalescence is absolutely necessary; the plaster jacket of Dr. Sayre, of New York, is in general use, and the one most to be recommended. See page 305.

AMPUTATIONS.

Amputations are operations for the removal of limbs.

General Considerations.—The principal causes that render amputations necessary are: Compound fractures with extensive laceration of the neighboring soft parts, involving the main artery, vein, or nerve of the limb; when a large joint is implicated with extensive comminution of the bone; when gangrene presents itself; when a malignant tumor includes the bone; when great deformities exist; when there are extensively lacerated wounds produced by machinery, or the rending of animals.

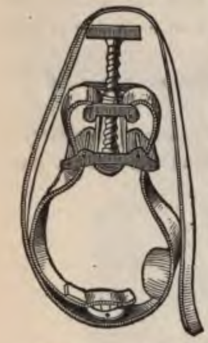
In compound dislocations, when the question arises whether to resect or amputate, where the main artery, vein, or nerve is uninjured, the preference is given to resection. This rule especially applies to injuries of the shoulder, elbow, hip, and ankle. In like injuries of the knee the rule is to amputate, because the popliteal artery and the neighboring vessels are apt to be involved.

Amputations are performed by the *circular* or the *flap methods* and their modifications. When performing an amputation the rule is to cut the flap so that there will be skin enough to cover the muscle, and muscle enough to cover the bone; the width of the flap should be one-half the circumference of the limb, and its length should be one-half its diameter.

When using the saw to sever the bone, the edge must be steadied by the thumb nail of the left hand; the saw to be drawn from heel to point. When sawing through the bones of a limb that has two bones, the lesser bone is to be first cut through; by following this rule, the smaller bone is less apt to be split, and there is less likelihood of straining the articulation of the two bones.

The articles needed for an amputation are: A tourniquet, either that of Petit, or the Esmarch apparatus; amputation knives, cutting bone forceps, lion jaw forceps, tenaculum, hæmostatic forceps, needles, Horsley's antiseptic wax, consisting of beeswax seven parts, almond oil one part, and salicylic acid one part; sponges, and retractors.

FIG. 75.



Petit's Tourniquet.

The retractor consists of a piece of muslin from six to eight inches wide, from two to three feet long; if the amputation is on a limb containing one bone, the muslin is to be torn half way up into two tails; if the limb has two bones, the retractor is to be torn into three tails; the middle tail goes into the interosseous space. Before being used the retractor must be rendered thoroughly antiseptic.

Amputations are designated as Primary, Intermediate, or Secondary.

A Primary Amputation is one that is performed as soon as practicable after recovery from the shock of an injury.

An Intermediate Amputation is performed during secondary wound fever, whilst the temperature of the individual is still high. It is resorted to after an unsuccessful effort has been made to save the injured limb, when the patient's general condition will not permit postponement.

A Secondary Amputation is one performed after the subsidence of fever.

The prognosis is most favorable in primary operations, and the least so in intermediate amputations.

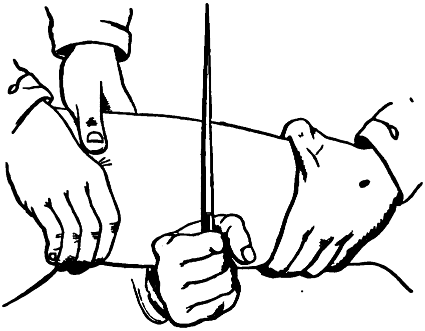
The methods of amputation are the Circular and the Flap.

The Circular.—When performing the circular amputation the operation is to be divided into three different steps: division of the skin and its separation from the underlying muscles; division of the muscles; division of the bone or bones.

When the operation is performed on the upper limb the section of the skin is to be made three inches below the point where the bone is to be sawed through; when on the lower limb four inches is to be allowed.

An assistant first draws the skin toward the trunk of the patient; the surgeon taking his knife in hand passes in beneath and behind the limb, and turning the instrument so as to face him he places the edge of the knife on the upper surface of the limb, as far forward as he can reach, and sweeps it entirely around the limb, describing a circle, and dividing the skin and cellular tissue. Separate the skin and cellular tissue from the deep fascia and turn it upward; the raw surface outward. The fascia and muscles are next cut through down to the bone by a circular cut, similar to that made when dividing the skin. The soft parts are now drawn up with the retractor; the periosteum is divided circularly, and the heel of the saw being placed upon the bone, and steadied by the thumb nail of the left hand, and drawn from heel to point to make a groove, is then directed to and fro from point to heel, with a slight pressure until the bone is cut.

FIG. 76.



Circular Method.

Flap Method.—The principal varieties of this method are: 1. Single Flap; 2. Double Flap; 3. Long Anterior Flap; 4. Long Rectangular Flap (Teale's); 5. Modified Flap; 6. Posterior Flap.

1. **Single Flap.**—This method is employed when injury or disease makes it impossible to obtain more than one flap. If possible it should be rectangular and at the same time wedge-shaped, and should include skin, fascia and muscle, the cut being either from without inward or by transfixion; the thin edge should be at the skin surface, and the base of the wedge at the point where the bones

are to be cut. The flap should be a little longer than the transverse diameter, at the point where the bone is to be divided, which should be at least an inch above the base of the flap.

2. **Double Flap.**—These flaps are made either by transfixion, or by cutting from without inward. The flap farthest from the vessel is first made. The flaps may be antero-posterior or lateral. The incision may be made through the skin and fascia, when the muscles can be cut by transfixion; but as a rule it is better to cut the flaps from without inward than to transfix them. The breadth of the flaps should be half the width of the limb, and the length slightly more than the diameter of the limb at the point where the bone is to be sawn through.

3. **Long Anterior Flap.**—This is made of skin and cellular tissue, without any posterior flap. It forms a flat-faced stump. It is used in amputation of the knee, etc.

4. **Long Rectangular** (Teale's).—This is a long and short rectangular flap. The long flap is cut so that the large blood-vessels and nerves will not be included; it is, therefore, anterior on the leg and posterior on the forearm. The length and breadth of the long flap are equal to half the circumference of the limb where the bone is to be divided. The short flap includes the arteries and nerves, and is one-fourth the length of the long one. The flaps are marked out with ink and raised from without inward, including the muscles. The bone is sawed at the angle of union. The long flap is bent so as to unite with the short flap, after the blood-vessels are tied.

5. **The Modified Flap.**—In this form the flaps include only the skin and cellular tissue. The muscles are divided at the base of the flaps, retracted, the periosteum divided, and the bone sawn through.

6. **The Posterior Flap** is chiefly used in amputation of the ankle joint, when Syme's operation is resorted to.

AMPUTATION AT THE HIP JOINT.

This operation is requisite in cases of cancerous or hopeless disease of the femur, and in those injuries in which the upper extremity of the thigh bone is crushed and the soft parts so much damaged that it is useless to attempt excision.

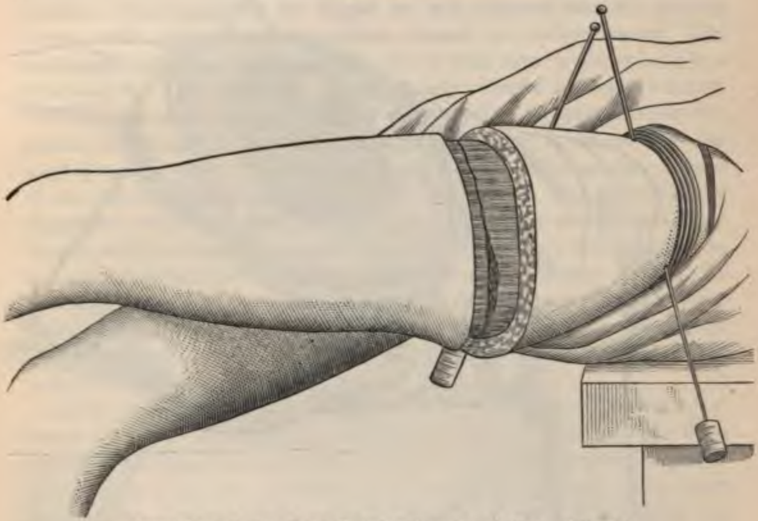
It is generally performed by flaps, either antero-posterior, lateral, or circular.

The *arteries* divided in this operation are the *muscular* and *femoral*, lying close together inside and in front of the bone.

The *internal circumflex* is also divided, and also the *external circumflex*. The great sciatic nerve and an accompanying branch of the ischiatic artery lie *in the posterior flap*, near its centre.

Wyeth's Bloodless Method.—Bring the hip well over the edge of the table, and apply Esmarch's bandage as high as possible; then take a steel mattress needle at least a foot long, or if preferred, a needle may be made for the purpose, and starting at a point one and a half inches below and slightly to the inner side of the anterior-superior spinous process of the ilium, pass the needle through the tissues about half way between the trochanter major and the iliac spine, external to the neck of the femur, so that the point will emerge just back of the trochanter. Pass a second needle an inch below the crotch and internal to the saphenous opening, so that the point will come out about an inch and a half in front of the tuber ischii; protect the points of the needle with cork; then pass a long piece of black pure rubber tubing, half an inch in diameter, tightly around the limb, above the needles, tying or clamping it. Remove the Esmarch bandage, and examine the femoral artery to ascertain if the circulation has ceased, if it has not, tighten the India rubber tube sufficiently to have it under complete control.

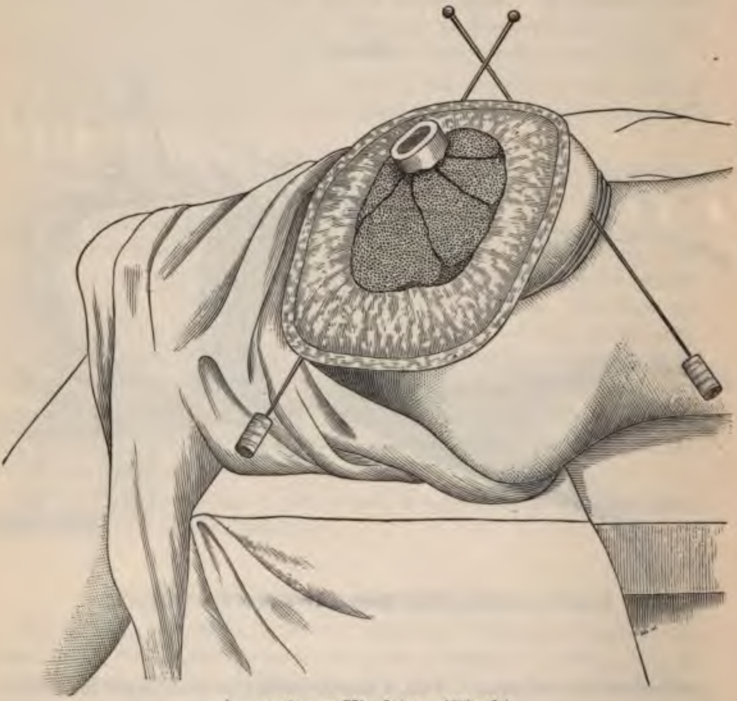
Fig. 77.



Amputation at Hip Joint, Showing Position of Pins. (*Wyeth.*)

Five inches below the pins make a circular incision down to the deep fascia, reflect back the skin and fascia to the level of the trochanter minor; at this point make a circular sweep with the knife, dividing the muscles to the bone at a much lower level than the trochanter minor, which gives the operator a handle wherewith the subsequent resection of the bone is rendered more simple. Secure all visible vessels, loosen the rubber band, tie all bleeding points. Then open the *capsule and* disarticulate the bone; this is facilitated by carrying the bone *directly upward, forward,* and inward, causing luxation to occur, when the liga-

FIG. 78.



Amputation at Hip Joint. (*Wyeth.*)

mentum teres can be readily divided. Control all hemorrhage in the usual manner, bring the flaps in apposition by means of sutures, place the drain externally, and seal the inner end of the wound with iodoform and collodion, in order to prevent infection from urine and feces (see Formula 96).

Senn's Bloodless Amputation.—The external incision is made about eight inches in length, parallel to the long axis of the femur, directly over the centre of the great trochanter, extending three inches above its upper border. When the knife reaches the trochanter from above downward, its point should be kept in contact with the bone the whole length of the remaining part of the incision. The margins of the wound are now retracted and any spurting vessels, such as the circumflex arteries, secured by pressure forceps. The trochanteric muscular attachments are now severed close to the bone with a stout scalpel. The thigh is then flexed, strongly adducted and rotated inward when the capsular ligament is divided transversely at its upper and posterior aspect. The remaining portion of the capsular ligament is severed while the thigh is brought back to a position of slight flexion. After complete division of the capsular ligament the thigh is rotated outward, and if possible the ligamentum teres is divided; if this cannot be readily done the head of the bone is forcibly dislocated upon the dorsum of the ilium by flexion, adduction and rotation inward of the thigh. After dislocation has been effected, the trochanter minor and upper part of the shaft of the femur are cleared by using alternately scalpel and periosteal elevator. By pushing the femur through the opening as much of the shaft can be cleared as may be desired for the purpose of making a low amputation.

Elastic constriction applied as here indicated will prevent further loss of blood: Bring the limb down in a straight line with the body, flex the thigh slightly, insert long, stout, hæmostatic forceps into the wound behind the femur and on a level with the trochanter minor; push the instrument inward and downward in a direction about two inches below the ramus of the ischium and just behind the adductor muscle. When its point is felt under the skin make an incision about two inches in length, through which the instrument is made to emerge. Enlarge the tunnel with the forceps, then with that instrument draw along the tunnel a piece of aseptic rubber tubing, three-quarters of an inch in diameter, and about three or four feet in length, withdrawing the forceps. The tubing having been grasped in its middle by the forceps, it is cut in two at that point. The anterior segment of the thigh is to be constricted sufficiently to completely interrupt both the arterial and venous circulation. Prior to constriction the limb is rendered bloodless by elastic compression and by keeping it in a vertical position for a few minutes. After having secured the necessary constriction, the elastic tubes are caught and held in a pair of strong forceps at a point where they cross each other. The posterior segment of the thigh is constricted by the remaining rubber tube, which is drawn tightly behind.

Muscular flaps should be avoided in this amputation; if the conditions for which the amputation is made permit, a long oval anterior and short superior skin flaps should be made, which are best adapted for a useful stump and efficient drainage. In making the anterior flap the incision is commenced at the lower terminus of the straight incision; dividing the tissues down to the muscles it is carried downward in a gentle curve across the anterior aspect of the thigh, embracing two-thirds of its circumference; it is then carried upward to a point on the inner side just below the opening of the skin occupied by the constrictors. The posterior flap is made in a similar manner, but about one-third shorter. The flaps including the deep fascia are reflected to the point where the muscles are to be divided; they are to be held out of the way whilst the amputation is being completed.

The incision through the muscles should be slightly conical; the apex of the cone pointing upward. The sciatic nerve is to be resected to the extent of an inch, and the arteries tied with catgut in the usual manner. The femoral artery and vein are now isolated and a second catgut ligature, including both of the vessels, applied half an inch higher up. The vein is thus ligated and the artery is secured by a double ligature.

During the operation the body of the patient is drawn down so that the pelvis rests upon the lower edge of the table, that the position of the thigh can be conveniently changed by the assistant who is entrusted with this work.

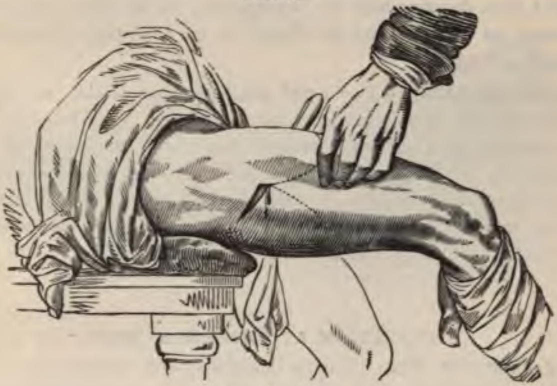
AMPUTATION OF THE THIGH.

The **Circular,** or **Flap Method** may be employed at the option of the operator.

Circular Method.—The surgeon stands at the outer side. One assistant must hold the limb, and another must draw up the skin as high as possible. Then the surgeon, grasping firmly the knife, with the point upward and the edge toward his arm, commences by passing his arm under the limb, laying the edge of the knife over it, and makes a transverse incision at one sweep, completely around the limb, through the skin and fat, down to the fascia. The knife cuts from heel to point. The assistant now draws upon the skin and folds it back like a coat cuff; and then the knife, being put close to the edge of the retracted folded skin, is made to divide the superficial vessels, and then cut everything down to the bone by a clear sweep. Then separate the muscles upward from the bone, for an inch or two, with the point of a knife, *and divide* the periosteum. The soft parts are next to be drawn up from the *bone by the retractor,* and lastly, the bone is to be divided by the saw. Should the bone be splintered, the projecting parts must be removed by the bone forceps. The femoral artery must now be secured, its orifice being grasped and slightly drawn out by the forceps; and afterward any large branches that appear in the muscular interstices. Then all compression should cease, so that arteries that are likely to bleed should do so. When the bleeding has finally ceased, the edges of the wound should be adapted with sutures, and a few long slips of plaster and a light bandage passed around the stump. The arteries divided are the *femoral*, the *profunda*, and the descending branches of the external circumflex.

Flap Operation.—The operator may stand on either side of the limb. In amputating the right thigh, he stands on the outer side and raises the flap with the left hand, and this gives him the power of grasping the main artery, with the flap, with that hand, and thus assisting in restraining hemorrhage. The flaps should be semilunar in shape, and should be of the same size; they should be cut from the lateral or antero-posterior aspect of the limb; the latter method is advised; they may be cut from without inward, or by transfixion; probably the best method is to cut semilunar anterior and posterior flaps through the skin and fascia to the muscles; each flap to be in width one-half the circumference of the limb at the point where the bone is to be divided. *The length* of the flaps should be rather longer than the semi-

FIG. 79.



Flap Operation.

lunar diameter. After the skin flaps are made the surgeon inserts a long amputating knife at the outer side, at the angle formed by the two flaps, and pushes it through the tissues until it reaches the bone; he then depresses the handle slightly to pass over the bone, carries the blade on until its point protrudes at the junction of the flaps on the opposite side; he then carries the knife on for about three inches, and in order to bevel the flap so that it will be spade-shaped without corners, he cuts forward and outward, and when he has secured a sufficient length he turns the knife so that it will *cut directly outward*, by which means the flap will be neatly bevelled; thick at the base and thin at the edge. The posterior flap is cut in the same manner. The vessels are then secured, the tourniquet removed, the flaps coaptated and care taken to secure proper drainage.

To insure the uniform width of the flaps, it is well to mark on each side of the limb a point denoting half the circumference of the limb, then placing the index finger on one side and the thumb on the other point, the operator cuts from thumb to finger.

The Modified Flap.—Two equal semilunar flaps of skin are raised from the fascia, the one anterior and the other posterior. The bases of the flaps must be equal, that is, each must embrace half the circumference of the limb, the convexities being toward the knee, and retracted two inches further; the muscles are cut directly down to the bone by a circular sweep of the knife. The bone is cleaned and sawn through two inches higher than where it was first exposed by the anterior incision through the muscles.

AMPUTATION AT THE KNEE JOINT.

Long Posterior Flap (Syme's Operation).—A semicircular incision is made through the skin and fascia, over the patella; next the knife is thrust horizontally across, immediately behind the joint, and is made to cut a long flap from the calf of the leg; next, the anterior flap being lifted up, the extensor muscles are severed from the upper border of the patella; the remaining soft parts are divided, and the femur sawn through the condyles, immediately above the joint.

Long Anterior Flap Operation.—An anterior flap may be made, including the patella, by a semicircular incision through the tissues in front, below the patella, from the posterior part of the condyle of the femur to the other. Then the *ligamentum patella* is cut through, the patella lifted with the anterior flap; the joint opened by cutting through the lateral and crucial *ligaments, and a posterior* flap cut from the calf.

The interarticular cartilages should be removed, and the surface of the patella and the femur, only if diseased. Some surgeons bring down the patella over the femur; others remove it.

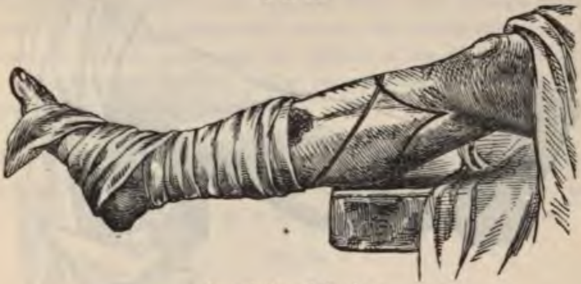
The arteries divided are the *anterior and posterior tibial*, *sural* and *articular* branches.

AMPUTATION OF THE LEG.

The "point of election" for amputation of the leg is three inches below the tubercle of the tibia; it is not recommended to preserve the limb beyond this, as a longer stump undoubtedly interferes with the comfortable use of the artificial limb now in vogue.

The operation is applicable to any portion of the leg below the knee joint to a point within three inches of the ankle, and probably the one to be most recommended is that known as the "antero-posterior flap," the two flaps being of the same length; that of the anterior being cut from without inward, and the posterior being procured by transfixion.

FIG. 80.

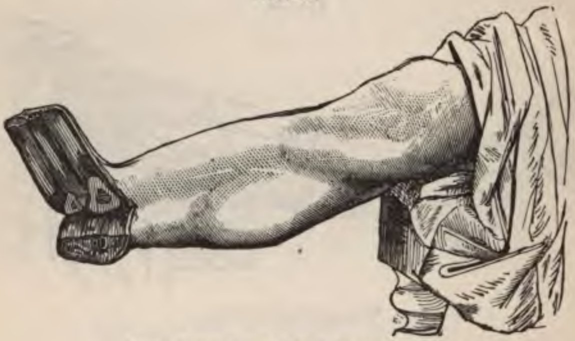


Amputation of the Leg.

The patient is brought well to the edge of the table; the limb to be removed is laid upon a pillow, supported at the heel by an assistant. The operator places the thumb of the left hand on a point just below the fibula, and the index finger a little below the line of the internal border of the fibula; with these points as guides, a semilunar flap is cut, somewhat longer than half the diameter of the limb, through the skin and fascia; this is dissected back to the points where the index finger and thumb of the left hand rest; a transfixion knife is then entered just below the fibula, and being carried through the tissues, is made to protrude on the other side, opposite the point of entrance, when a *posterior flap* is cut of the same length as that for the anterior. Any muscles which have not been divided are to be severed by a circular sweep of the knife; the interosseous space is divided, the periosteum pushed back, and the bones sawn through. After the limb has been removed saw off the sharp edge of the tibia and cut off half an inch of the fibula, which insures a better stump. Secure the vessels, apply necessary drainage, and close the wound in the usual manner.

Double-flap Method, at the upper fourth of the leg. A stout bistoury, with blades four or five inches long, and a broad saw, are the cutting instruments required. The flaps are made of integuments only, by cutting from the surface without transfixion. The point of the knife is entered at the side, about two inches below the tibial tubercle, and carried across the front of the leg, describing an anterior curved flap, rather longer than, and of the exact width of, the half diameter of the limb. This is dissected up close to the bones and deep fascia. A similar flap is made on the posterior aspect, and the integuments and fascia composing it are raised from the muscles. The latter, with the large vessels and nerves, are then divided transversely, direct to the bone. The point of the knife must be used to divide the intervening structures. The bones are then divided, equally across.

FIG. 81.



Long Anterior and Short Posterior Flap.

The *anterior tibial artery* is often divided as it passes between the bones to the front of the leg, and it may be difficult to get it separated from the surrounding ligamentous structures.

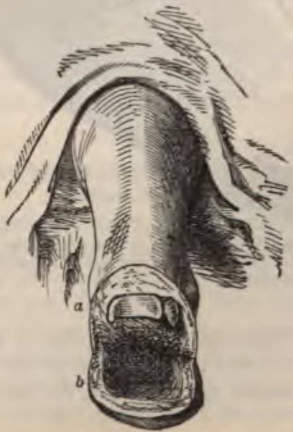
Single-flap Operation.—The operator places the heel of the knife on the side of the limb furthest from him, then draws it across the front of the limb, cutting a semilunar flap of skin; when its point arrives at the opposite side, it is made to transfix the limb, and then the posterior flap is cut. Care must be taken not to get the knife between the bones when making the flap by transfixion. The muscles and ligamentous structures which are between the bones are then divided by the point of the knife. The fleshy mass of the gastrocnemius may require to be cut out, to make the posterior flap thinner.

The Circular Operation is especially adapted to removal of the leg at the lower third of its length. One assistant supporting the foot, and another holding the knee, and at the same time drawing up the skin, the surgeon makes a circular incision through the skin, four inches below the point where the bones are to be divided. The integuments are then dissected up for two inches and turned back, and the muscles divided down to the bone by a second or third circular incision. A catlin is then passed between the bones to divide the interosseous ligament and muscles, and both bones sawn through together, the flesh being protected by a three-tailed retractor, the middle tail passing between the bones; to prevent splintering, the division of the fibula should be completed before that of the tibia. The *anterior* and *posterior tibial* are the principal arteries requiring ligatures.

AMPUTATION AT THE ANKLE JOINT. (Tibio-tarsal Articulation.)

Syme's Operation.—Find the tip of the external malleolus, and then mark a point nearly opposite to it on the inner side of the ankle. This is

FIG. 82.

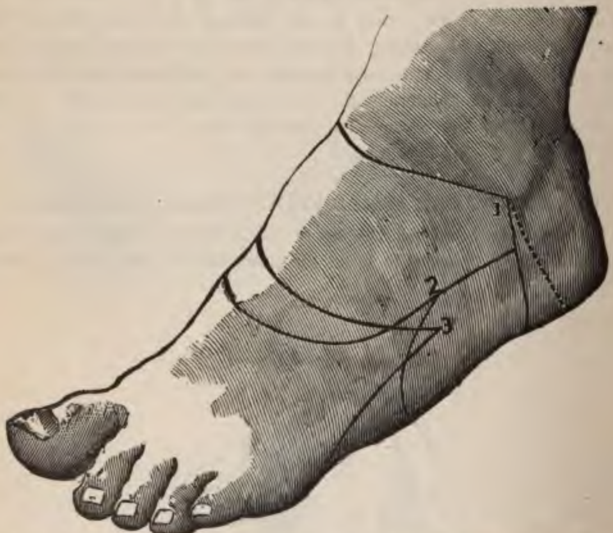


Syme's Operation.

about half an inch below and behind the internal malleolus; these points are joined by two incisions, one passing vertically under the sole of the foot and the other over the dorsum, so as to make an angle of 120° with the first. The first incision should be inclined backward rather than forward, so that the lower flap may be very short; the next step is to dissect the lower flap from the os calcis When this is done the short upper flap is dissected from the dorsum. The foot is then forcibly extended, the ankle joint opened and the foot removed. The malleoli are then sawn off and the flaps brought together with sutures.

Pirogoff's Operation.—Instead of dissecting out the entire os calcis, Pirogoff removes the anterior part only of the bone, which supports the astragalus.

FIG. 83.



1. The Incisions in Pirogoff's Amputation. The dotted line shows the direction of the plantar incision in that of Syme. 2. The incision is sub-astragaloid; and 3, those in Chopart's Amputation. (*Jacobson.*)

In this amputation the first incision is begun close in front of the malleolus and carried straight down to and transversely across the sole of the foot, then *obliquely upward* and forward to the front of the inner malleolus, dividing everything down to the bone. The incision is then brought obliquely forward on the inner side, so as to cut the *posterior tibial* artery before its division into its *plantar* branches. The ends of this incision are connected by a semilunar one across it into the ankle joint. Then the lateral ligaments are divided and the posterior part of the capsule; with a narrow saw the os calcis is now cut obliquely from behind forward and downward. Then the malleoli are sawn off, with a thin slice of the tibia, if diseased. Lastly, the cut surface of the os calcis is brought into contact with that part of the tibia, and the wound is united with sutures.

AMPUTATIONS OF THE FOOT.

Amputations of the Toes at any of their joints is performed in precisely the same manner as amputations of the fingers. (See page 218.) In removing a single toe from its metatarsal bone, the surgeon should take care to ascertain the exact situation of the joint, which lies rather deeply and much further back from the prominent knuckle of the toe than is at first sight apparent. If possible the head of the metatarsal bone should not be removed, if it can be avoided, as it is important to preserve the breadth of the foot.

Amputation of all the Toes at their Metatarsal Joints.—Performed by first making a transverse incision along the dorsal aspect of the metatarsal bones, dividing the tendons and lateral ligaments of each joint in succession; and then the phalanges being dislocated upward, the knife is placed beneath the metatarsal extremities and made to cut out a flap from the skin on the plantar surface, sufficient to cover the heads of the metatarsal bones.

Amputation of the Metatarsal Bone of the Great Toe.—An incision with a scalpel is carried along the dorsum down to the bone and around the root of the toe. Then the knife is kept as close to the bone as possible, dissecting it out from the surrounding parts. Then the bone is removed at the metatarso-cuneiform joint, by division of the tendons and ligaments.

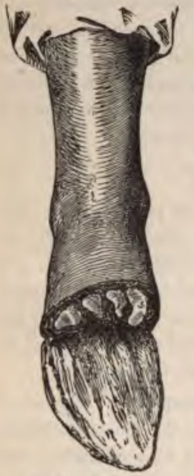
AMPUTATION AT THE TARSO-METATARSAL ARTICULATION
(Lisfranc's Operation).

Directions for Locating the Tarso-metatarsal Articulation.—Find the articulation on the outer side, by locating the prominence at the base of the metatarsal bone of the little toe, which indicates the position of the articulation between the metatarsal and cuboid bones. Draw a line from the base of the metatarsal bone of the little toe directly across the instep, advance forward from this point half an inch, which gives the point of junction between the metatarsal bone of the big toe and the internal cuneiform bone.

The exact situation of the articulation of the great toe to the inner cunei-

form bone being ascertained, a semilunar incision with the convexity forward is made through the tegumentary structures across the instep, from a point just in front of the aforesaid articulation to the outside of the tuberosity of the fifth metatarsal bone. This flap is turned back and the bistoury is first to be passed straight across the tendons and vessels, so as to cut them a little shorter than the integuments, and then around behind the projection of the fifth metatarsal bone, so as to divide the external ligaments which connect it with the cuboid. The dorsal ligaments are next cut through, the bones being at the same time well depressed. The third and fourth are to be disarticulated in a similar manner. The first metatarsal is next attacked, and lastly the second, the extremity of which, being locked in between the cuneiforms, will be more difficult to dislodge. When all the five bones are disarticulated, the surgeon completes the division of the plantar ligaments and separates the textures which adhere to them with the point of the knife, and then, the foot being placed horizontally, he puts the blade under the five bones and carries it forward along their inferior surface as far as the root of the toes, so as to form a sufficient flap.

Fig. 84.



Lisfranc's Operation.

Hey's modification of Lisfranc's operation consists in sawing off the *projection of the internal cuneiform bone*, and thus forming a regular surface.

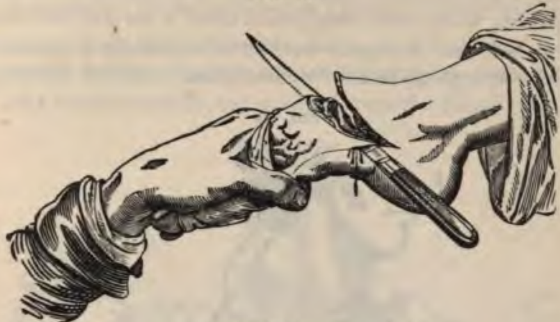
AMPUTATION THROUGH THE MEDIO-TARSAL ARTICULATION
(Chopart's Operation).

To remove the navicular and cuboid bones, with all parts in front of them.

Directions for Locating the Medio-tarsal Articulation.—Measure back half an inch from the prominence at the base of the fifth metatarsal bone, which gives the point of articulation between the cuboid bone and the os calcis; draw a line from this point directly across to the inner aspect of the foot, which will indicate the point of junction between the scaphoid and astragalus.

In the first place, the articulation of the *cuboid* with the *os calcis*, and that of the *scaphoid* with the *astragalus*, must be sought for, and a semilunar incision must be made across the dorsum from one to the other, as in the foregoing operation. The flap of the skin being turned back, the internal and dorsal ligaments that connect the *scaphoid* to the *astragalus* are to be divided with the *point of the bistoury*. The ligaments connecting the *os calcis* and *cuboid* are next divided, and lastly a flap is taken from the sole of the foot. If the heel is drawn backward it may become necessary to divide the tendo-Achillis.

FIG. 85.



Chopart's Operation.

In these amputations the *dorsal region* of the foot, and the external and internal plantar branches usually require ligatures.

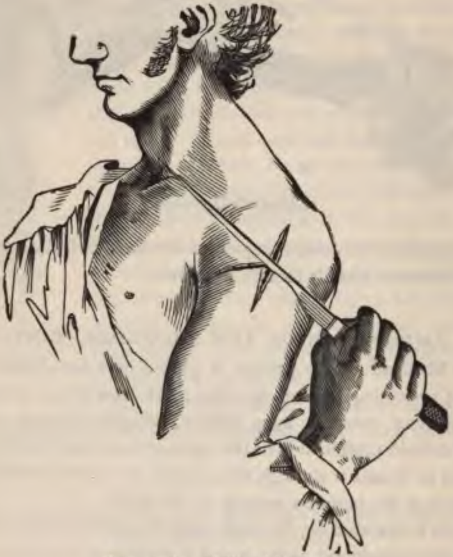
AMPUTATION OF THE SHOULDER JOINT.

The Flap Method.—The patient is placed on a firm table, with the arm well raised and projecting beyond its edge; the subclavian artery being compressed, the operator enters a long, narrow, straight bistoury at the anterior margin of the deltoid muscle, if it be the right arm, an inch below the acromion. From this point he thrusts it through the muscle, across the outside of the joint, and brings it out at the posterior margin of the axilla.

If the left arm is operated on, the knife must be entered at the posterior margin of the axilla, and brought out at the anterior margin of the *deltoid*. Then, by cutting downward and outward, the external flap is made. The arm is then brought down to the side and forcibly adducted; the origins of the *biceps* and *triceps* and the insertions of the *infra-* and *supra-spinatus* are cut through and the joint laid open. Finally the blade of the knife, being passed through the joint and placed on the inner side of the head of the bone, is made to cut an inner flap of the same shape, but rather shorter than the outer one.

Oval Method (Larrey's Bloodless Method).—In order to control hemorrhage pins similar to those already described for amputation of the hip joint (see page 201) are now employed; one to be passed through the pectoralis major and brought out in front of the acromion process; the other passed *through the latissimus* dorsi and brought out back of the acromion; the points are to be protected by cork. The rubber band is to be put on above the line of operation, which is to be removed as soon as the limb is amputated and the vessels secured. Make a straight incision immediately beneath the acromion process, and a little toward the anterior border of the axilla, with a moderate-sized amputating knife, which should reach down to the bone, and should be between two and a half to three inches in length; from the lower end of this incision two others are prolonged, the first passing in a curved direction downward and backward, and the second forward toward the folds of the axilla; the blood-vessels and the inner or axillary aspect of the arm remaining untouched. The flaps are then dissected back, including the muscles and exposing the joint. The head of the bone is then disarticulated by cutting upon the tuberosities; the arm being rotated inward and outward. The arm is then adducted, throwing the head of the humerus outward, and the knife passed to the inner side and carried downward close to the bone, an assistant at the same time compressing the artery. Then the tissues between the axillary folds are divided by an oblique cut from within outward, so as to form part of the internal incision.

Fig. 86.



Amputation of Shoulder Joint.

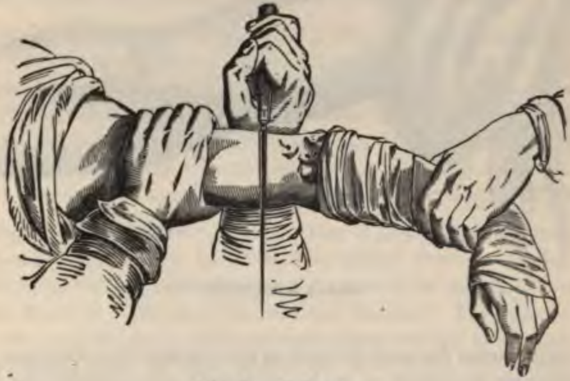
The axillary, and branches of the *anterior* and *posterior circumflex and supra-scapular arteries* require to be tied.

AMPUTATION OF THE ARM.

In amputations of the upper extremity the flow of blood may be sufficiently controlled by digital compression of the artery above the clavicle, or in the arm against the humerus. Or the tourniquet, or Esmarch's bandage may be applied.

1. **Circular Amputation.**—The arm being held out, and an assistant drawing up the skin, one circular incision is made through the integuments, which being forcibly retracted and detached from the deeper structures and doubled back to the extent of two inches, another is made to the bone. The subsequent steps are precisely similar to those described in ampuiation of the thigh.

FIG. 87.



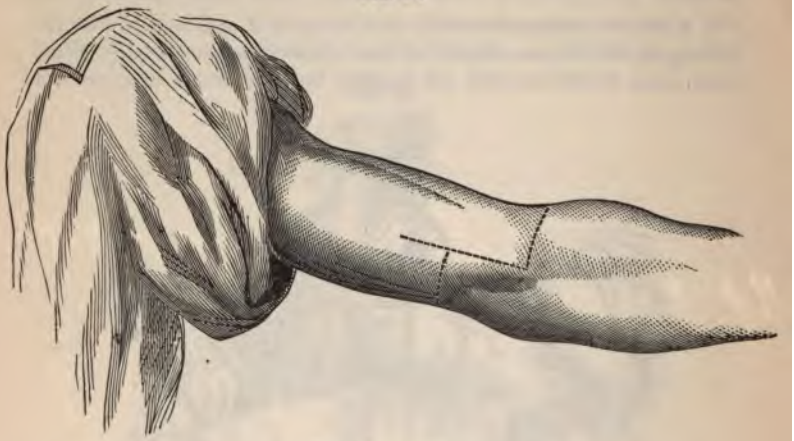
Circular Amputation.

2. **Antero-posterior Flaps.**—The knife is extended at one side and carried down to the bone, turned over it, brought out to a point opposite and then made to cut a neat rounded anterior flap, three inches long. The knife is next carried behind the bone to make a posterior flap of equal length, and is lastly swept around the bone to divide any remaining fibres with the periosteum; the vessels are cut when the posterior flap is being formed. The division of the bone, ligature of the arteries and treatment of the stump as heretofore.

Besides the *brachial artery*, the *superior profunda* and the *inferior profunda* require ligatures.

3. Rectangular Flap Method (Teale's Amputation).—This method of operation is chiefly advisable in cases of injury attended with great loss of soft parts.

FIG. 88.



Teale's Amputation.

The long anterior flap must be made so that the inner line of incision shall be sufficiently near the margin of the biceps muscle not to involve the brachial artery. The short flap is to be taken from the posterior aspect of the limb.

AMPUTATION OF THE ELBOW JOINT.

1. By an Anterior and Posterior Flap.—The arm being extended, the surgeon cuts a semilunar anterior flap, three inches in length, from the internal to the external condyle; then slightly flex the arm and cut a posterior flap of the same width and length.

The anterior flap is to be raised from the bones as far as the line of articulation; the external lateral ligament is next divided; the knife is then passed into the joint between the head of the radius and the external condyle. Divide the internal lateral ligament and dissect the posterior flap back a little beyond the end of the olecranon process, when it can be easily disassociated from the socket, and then by a few touches of the knife the limb is severed. Secure the *arteries and adjust the flaps.*

2. **Circular Operation.**—Make a transverse incision three and a half inches below the inner trochlea. Raise the skin and fascia for an inch, then divide the muscles circularly. Forcibly retract these; again divide the deep muscles transversely, together with the external lateral ligament, on a level with the radial articulation. The head of the radius is recognized and the joint opened by entering the knife between the radius and humerus, dividing the external ligament. The olecranon is then drawn forcibly downward, and the triceps divided at its insertion, and the remaining tissues from within outward.

AMPUTATION OF THE FOREARM.

Always perform this operation as near the wrist as possible.

1. **Circular.**—The limb being supported with the thumb uppermost and an assistant drawing up the skin, a circular incision is made through it, down to the fascia. When the integument is retracted and folded back about an inch, the muscles and tendons are divided by a second circular incision; the interosseous parts and the remaining fibres are next cut through; the bones are then sawn through together and of equal length, and projecting tendons trimmed off. The *radial*, *ulnar* and one or two *interosseous* arteries require ligatures.

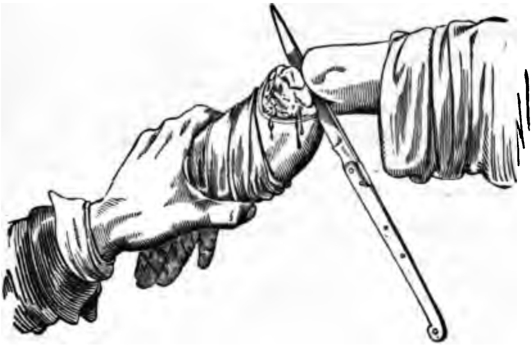
2. **Flaps.**—The limb being placed in a state of pronation, the surgeon makes a flap from the extensor side by cutting from without inward; the flap should be in width one half the circumference of the limb at the point to be removed: its length should be a little more than its semi-diameter. The posterior flap is to be of the same size and made in the same manner as that for the flexor side. The interosseous parts are then divided, the flesh drawn upward, the bones sawn through, and the tendons trimmed off. The vessels to be secured are the radial, ulnar and interosseous arteries, and probably some of their muscular branches.

3. **Long Rectangular Flap** (Teale).—This flap is made from the back of the forearm. The radial vessels are included in the shorter flap. In tracing the long flap, a longitudinal line is drawn over the radius external to the vessels; at the distance of half the circumference of the limb another line is drawn parallel over the ulna. These are joined across the dorsum by a transverse line. The short flap is formed by a transverse line across the front, joining the long ones at the upper fourth. When dissecting the long flaps from below upward, the tissues must be separated close to the periosteum and interosseous membrane, and the bones sawn through at the angle of union. The vessels having been ligated, the stump is to be placed in the prone position, so that the long flap may fall over the ends of the wound and be approximated to the short flap, in the usual method.

AMPUTATION OF THE WRIST.

1. **Circular.**—The skin being pulled back, a circular incision is made a little below the level of the line that separates the forearm from the palm of the hand. The integument must be turned back as far as the line of the radio-carpal joint. The external lateral ligament is then cut through, and the knife carried across the joint to divide the remaining attachments. The styloid process of the radius and ulna should be removed with the cutting forceps, the tendons trimmed and the integuments brought together with sutures.

FIG. 89.



Flap Amputation of the Wrist Joint.

2. **Flaps.**—A semilunar incision is made across the back of the wrist, its extremities being at the styloid processes, and its centre reaching down as far as the second row of carpal bones. Dissect up the flap of integument and fascia, flex the hand, and divide the extensor tendons across, opposite to the joint. The joint being opened behind, and the lateral ligaments cut through, and the knife being placed between the carpus and forearm, is made to cut out a flap from the anterior surface of the palm.

AMPUTATIONS OF THE FINGERS.

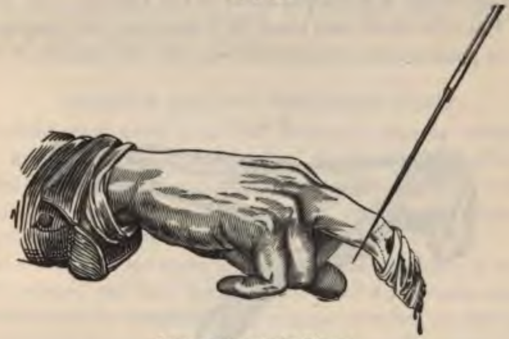
Fingers and Toes are amputated by flap methods. At the metacarpo- and metatarso-phalangeal articulations, by the oval method, so that the resulting scar may not be on the palm of the hand nor on the sole of the foot.

When amputating at the metacarpo-phalangeal articulation of the thumb or *little finger, or at* the metatarso-phalangeal articulations of the great and little toes, the wound is made in such a manner that the scar will be on the side of the hand or foot. In the removal of the remaining fingers and toes at the articulation, the cut is made so that the scar will be on the back of the hand or foot and between the adjacent bones.

When amputating fingers it is to be borne in mind that the joint in the last row of the phalanges is one-twelfth, the middle row one-sixth, and the metacarpo-phalangeal articulation one-third of an inch back of the most prominent part of the knuckle.

When amputating a finger the anterior and posterior flaps must be of the same size; the finger must be alternately extended and flexed until the exact position of the joint is ascertained; the knife is then entered at the side of the finger at the articulation and carried down to the bone; a straight incision is then made a little over a quarter of an inch in length, and a like incision made on the opposite side; the ends of these cuts are joined by a circular sweep. Then dissect up the anterior and posterior flaps and disarticulate the joint; draw down and cut off the tendons and close the wound. Ligatures are unnecessary, as the sutures will control hemorrhage.

FIG. 90.



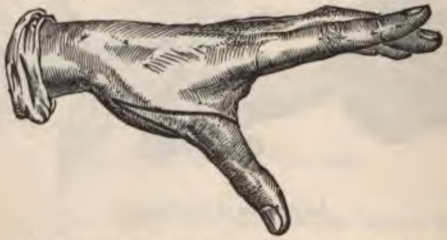
Amputation of the Finger.

Amputations of the fingers or thumb at their distal joints are performed by the operator holding the phalanx firmly between the finger and thumb and bending it, so as to give prominence to the head of the middle phalanx. He then makes, with a scalpel, a straight incision across the dorsal skin, over the head of the middle phalanx, along the distal groove of the knuckle, so as to cut into the joint deeply enough to divide the lateral ligament. The knife is carried through the joint, and cuts a flap from the palmar surface of the last phalanx, sufficient to cover the head of the bone.

Amputation of the Finger at the Metacarpo-Phalangeal Articulation. While an assistant supports the hand and remaining fingers, the surgeon grasps the finger to be removed and makes firm extension; then with a sharp and narrow bladed knife he starts the incision one-third of an inch back of the most prominent part of the knuckle, extending the cut across the joint as far as the web of the finger, where it is made to deviate from a straight course, passing first laterally on the inside and then to the outside; the incision to be joined on the palmar surface, making an oval cut down to the bone. The joint is opened from the front and disarticulated. The vessels are next secured and the flaps approximated.

Amputation of the Metacarpal Bone of the Thumb.—*By anterior flap operation.* Hold the thumb out; insert the bistoury near the metacarpo-phalangeal joint; its point is thrust between the bone and the muscles of the ball of the thumb, and as close to the bone as possible, and brought out just above the articulation with the trapezium. The bistoury is then made to cut its way outward, and the point of the knife is carried from the upper end along the bone, and around the metacarpo-phalangeal joint, to meet the other incision. The bone is disarticulated by being forcibly abducted, and the ligaments on the inner side of the metacarpo-trapezial joint cut through first.

FIG. 91.



Amputation of the Metacarpal Bone of the Thumb.

Amputation of the Metacarpal Bone of the Little Finger.—An incision is made along the ulnar border of the dorsum of the bone, and carried around to encircle obliquely the root of the little finger. The skin and flesh are dissected off, as closely as possible to the bone, and the bone is disarticulated, by the point of the knife, from the unciform, while the ligaments are stretched to their utmost by extreme abduction.

After the amputation of any portion of the hand, a splint should be used when dressing the part.

EXCISION OF JOINTS.

When joints are hopelessly diseased, or so extensively injured as to threaten the life of the individual, and render repair impossible, cutting out the portion of diseased or injured bone is resorted to instead of amputation.

It is now well established that in many joints, excision is better and safer than amputation; less violence is done to the body; fewer great arteries, nerves and veins are divided, and the patient is left with a limb, which, although imperfect, is in most cases highly useful.

EXCISION OF THE SHOULDER JOINT.

Surgeons differ as to which is the best incision to make in commencing this operation; many authorities recommend an anterior, in front of the deltoid; Nélaton used the transverse, and Ashtonkey the deltoid flap. Bryant advocates a vertical incision from the acromion process, through the thickness of the deltoid down to its insertion.

Make the vertical incision down to the bone, rotate the head of the humerus successively outward and then inward; then make a transverse cut across the tuberosities to divide the insertions of the scapular muscles. Divide the capsule; turn the head out of the wound, and resect through the tuberosities. Should the glenoid cavity be diseased, the dead bone must be removed.

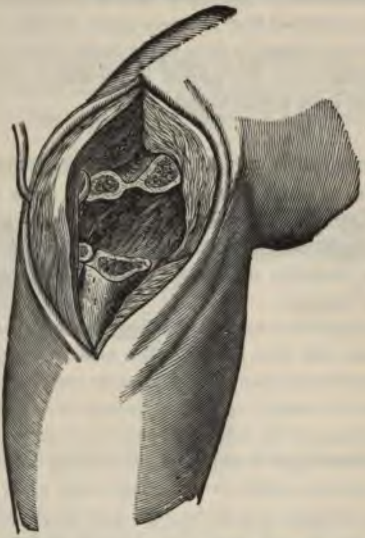
When the vertical incision is employed, an opening must be made posteriorly through the soft parts, at a point corresponding to the upper end of the humerus, for the purpose of drainage; it must be kept open by means of a drainage tube.

After the operation, the arm should be abducted and placed on a pillow, the edges of the wound carefully brought together, and dressed antiseptically. Three or four months are required to secure a useful arm.

EXCISION OF THE ELBOW JOINT.

The patient is laid on his back, and the arm held with the hand in a prone posture by two assistants, one of whom holds the arm and the other the forearm. A straight vertical incision, four inches long, through the skin and subcutaneous tissues, is then made a little to the ulnar side of the hinder surface of the joint; its centre about the level of the olecranon, and to the outer side of the groove wherein the ulnar nerve lies. Deeper cuts are then made round the upper border and sides of the olecranon, laying bare the condyles of the humerus, and separating the origins of the muscles of the forearm, and cutting into the joint transversely, severing the triceps from the olecranon. The ulnar nerve is drawn inward, off the inner condyle, by a double blunt hook, and protected from the saw, the lateral ligament severed, the elbow forcibly bent, so as to turn out the ends of the bones. The olecranon may now be cut off with the saw or forceps, when it will be clearly seen what other portions of bone are diseased. The end of the humerus, as well as the head of the humerus may now be removed. Enough bone must be removed to prevent ankylosis. As much of the brachialis anticus must be removed from the coronoid process as may be necessary; the triceps tendon must be left as long as possible.

FIG. 92.



Section of the Bones in Excision of the Elbow Joint. (*Moullin.*)

When the bleeding has ceased, the wound is to be brought together by *sutures, dressed antiseptically*, and the arm in a half-bent posture, laid upon a *well-padded angular* splint, and secured by bandages.

When the reparative stage has fairly set in, the arm is to be moved from time to time, so as to form a *false joint.*

There are many varieties in the plan and shape of the incisions; the most practical is to make the incisions connect and fall into the tract of any sinuses that may exist. In short and muscular men the H incision is the best, especially if there be much enlargement of the joint.

EXCISION OF THE WRIST JOINT.

The incisions and modes of procedure in this operation vary in each case according to the situation and extent of the disease; no precise rules can, therefore, be laid down.

The form of the incision must be guided by the presence of the sinuses on the surface; by following these a sufficient opening may be usually made between the extensor tendons and the bones.

One of the most usual modes of operating consists of longitudinal incisions on both sides of the wrist joint, or incisions on the dorsal and internal lateral aspects, directed so as to go between the tendons without dividing them. An incision to the ulnar side of and parallel to the tendon of the *extensor secundi internodii pollicis*, and another vertical on the inner side of the joint, between it and the *flexor carpi ulnaris*, will give sufficient room to remove the diseased carpal and bases of the metacarpal bones.

EXCISION OF THE HIP JOINT.

To perform this operation, make a long, straight incision down the outer side of the limb, beginning below and behind the anterior superior spine of the ilium, and passing over the great trochanter. The attachment of the muscles having been severed from the trochanter, the bone is turned out of the wound by raising, and adducting it at the knee; the neck and head of the bone, if necessary, to be dissected out of the acetabulum.

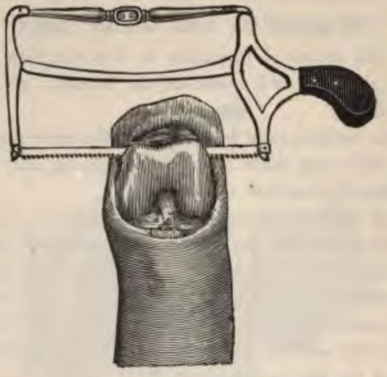
Another method of performing this operation is to make a semicircular incision, beginning just above the edge of the *tensor vaginæ femoris*, and curving downward and outward, so as to cross the bone an inch below the trochanter, from whence it should turn a little upward. This flap, including skin, fascia lata, *tensor vaginæ femoris* and part of the *gluteus maximus*, should be turned up, the muscles attached to the injured parts divided, and complete the remaining steps of the operation as above.

Excision of the hip joint should be performed with antiseptic precautions. If foul sinuses exist they may be scraped with a sharp spoon and cleaned well with a sponge dipped in a solution of sulphate of zinc. Antiseptic dressings may be then applied and the limb fixed in a long splint.

EXCISION OF THE KNEE JOINT.

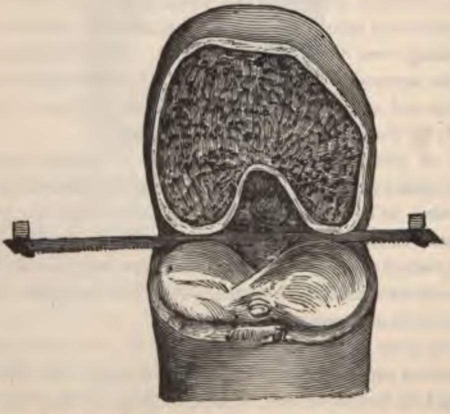
Make a semicircular incision, with the convexity downward, commencing at the side of one condyle of the femur and passing immediately above the

FIG. 93.



Excision of Knee Joint. Removal of Condyles of Femur.

FIG. 94.



Excision of Knee Joint. Removal of Head of Tibia.

tubercle of the tibia, to a corresponding point on the opposite condyle. This incision divides the ligamentum patellæ, and the patella is turned up in the flap; the crucial ligaments are then to be cut across, and any remaining lateral attachments divided. The limb must now be forcibly flexed, and the knife carefully applied to the posterior part of the head of the tibia; a blunt-pointed resection knife is best for this purpose. Saw off the articular surfaces. The lower end of the thigh-bone should first be removed; it must be made accurately at right angles to the shaft of the femur in the antero-posterior direction.

A thin slice is next taken off the tibia; the section must be accurately at right angles to the shaft of the tibia.

Care must be taken not to remove more of the bones than is absolutely necessary, especially in young subjects.

If the patella be much diseased, it must be removed; if it be only slightly carious it may be scraped or gouged out; if healthy, it should be left to consolidate and strengthen the joint.

To keep the bones in position, they should be drilled obliquely at the anterior part, and secured by a couple of strong sutures of catgut. If the wound be not aseptic, wire sutures are the best. Before the wound is closed, all hemorrhage must be thoroughly arrested. Ligatures must be applied to the articular arteries, if necessary. The limb must be kept at perfect rest for the first few weeks; a narrow, properly-padded splint, extending from the hip to the heel, will answer all indications. It should be fixed in position by a flannel bandage above and below the knee, over which a firm plaster-of-Paris bandage must be applied. The first dressings should be changed after twenty-four hours. After that the dry, antiseptic wool dressings should be used, which can be left untouched for two or three weeks.

EXCISION OF THE ANKLE JOINT.

Place the foot on its inner side, and make an incision along the posterior face of the fibula, beginning three inches above its lower extremity, and after reaching the end of the malleolus, change its direction, and terminate about half an inch short of the metatarsal bone of the little toe. Raise the flap and reflect it forward, exposing the surface of the fibula, taking care not to injure the tendons of the peroneus longus and brevis muscles, which lie against the posterior and outer surface of the bone. The fibula is now to be cut through with strong bone-pliers, and its lower extremity dissected out.

Should the disease be found to be very limited and accessible, the one incision here recommended will suffice; if the disease is more extended, the foot must be placed on its outer surface, and a second incision must be made along the inner angle of the tibia and terminating at the internal cuneiform bone.

Dissect back the flap, keeping close to the bone, so that the tendons of the *tibialis posticus, flexor longus digitorum*, and the posterior tibial artery, veins and nerves, may be raised without injury. Hold these parts aside, and cut away the internal malleolus with the bone-pliers, and divide the internal lateral ligament.

Clear the bone in front and behind with the handle of the scalpel, and strongly evert the foot when the tibia and upper surface of the astragalus will be exposed at the internal wound.

The bone can now be divided from behind forward, by a narrow-bladed saw being passed through the internal wound, behind the tibia, and made to appear at the external opening. The upper surface of the astragalus may be now sawn off.

The wound must be thoroughly washed out with bichloride solution, a drainage tube passed through from one side of the joint to the other, the sides of the incision closed by interrupted sutures, and the whole dressed antiseptically.

The foot and leg must be covered with a bandage and plaster rollers applied, care being taken to give the foot a proper angle with the leg, the foot being held by the hand of an assistant until the plaster is hardened. Traps are to be cut on the sides of the splint opposite the wounds.

WHEN EXCISION IS ADMISSIBLE.

Erichsen, in his work on the "Science and Art of Surgery," lays down the following general rules for the performance of resections of joints in cases in which it is admissible :—

1. As a substitute for amputation in cases in which the joint is so extensively diseased that the patient will be worn out by the discharge or pain, unless it be removed.

2. In some cases of articular disease in which amputation would not be justifiable, excision may be done in order to hasten the cure, and this saves years of suffering to the patient.

3. Excision may be done in cases in which *amputation is not practicable*, as in some cases of disease of the hip joint, or of the temporo-maxillary articulation.

4. As a substitute for other and less efficient treatment; in order to *restore the utility of a limb to a joint;* as in osseous ankylosis of the elbow, or in faulty ankylosis of the knee.

5. Excision may be required, in bad compound dislocations and fractures into *joints, especially in gunshot* injuries, more particularly in those of the head of *the humerus,* and of the bones entering into the elbow joint.

As a general rule excisions are required only in those cases in which the articular ends of the bones are diseased either primarily or secondarily.

Conditions of Success.—For resection to succeed, the following conditions appear to be necessary:—

1. The disease should not be too extensive, so that its removal would entail such an amount of mutilation of the limb as to render it less useful to the patient than an artificial member would be. This is especially important in the lower extremity.
2. The disease for which resection is practiced should be allowed to become chronic before any operation is undertaken.
3. The soft parts about the joints must be in a sufficiently healthy state.
4. The state of the patient's constitution must necessarily influence the surgeon materially in his determination, whether to resect or to amputate.
5. The extremes of life are unfavorable to resections.

LIGATION OF ARTERIES.

General Considerations.—Arteries are ligated in their continuity to eradicate aneurisms, to arrest hemorrhages, and to control acute inflammations.

When operating the greatest caution must be exercised to prevent the wound becoming infected, causing sloughing to ensue, when septicæmia or pyæmia may result, terminating in secondary hemorrhage.

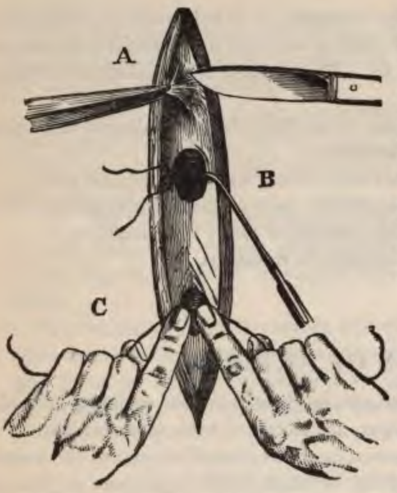
When about to ligate an artery the operator must be careful to first establish its true course, which may often be determined by a line drawn to connect two anatomical points, which when ascertained will lie over the track of the vessel. This line is of service as indicating where the incision in the skin should be made, which must always be at an angle of five degrees to the line of the artery.

The length of the cut varies with the location of the vessel, its size, and its depth from the surface.

Precise directions as to the proper length of the incision will be given in each case when describing especial operations.

It is a good rule to allow too much rather than too little room when making the external incision. After the skin has been divided, the fascia is to be taken up on a grooved director and divided to the length of the wound made in the skin. With but few exceptions the muscles should be separated one from the other by means of the handle of the scalpel; when the sheath of the artery is reached it is to be gently picked up by a pair of dissecting forceps; the forceps should be *lateralized* in order to lift the sheath from the vessel; which should then be very carefully nicked and torn through with a director. The opening should be made no larger than is sufficient to allow the aneurism needle to pass freely around the artery. The vessel must then be very carefully separated from its surrounding structures, and the armed aneurism needle carried around the artery, passing it away from, rather than toward the vein or nerve, should there be an accompanying vein or nerve; the needle is then withdrawn, leaving the ligature behind, which is tied, the ends cut off, and the wound closed in the usual way.

FIG. 95.



This diagram represents three distinct operations. A. Opening the Sheath. B. Drawing Ligature round the Artery. C. Tying Artery. (*Bryant.*)

The points that assist the operator in finding the artery are its *line*, its *guiding muscle*, and its *pulsation*.

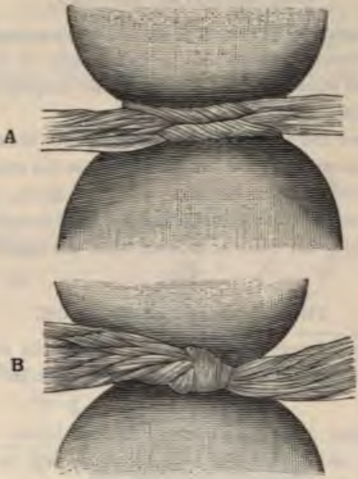
The *guiding muscle* is recognized, when by using either flexion and extension, or pronation and supination, the muscle is caused to "spring," as it is technically called.

The artery must be tied as far as possible from the nearest branch, as the clot that is formed never extends beyond the nearest point of junction, and it may thus be found too short to plug the artery, and liability to dangerous hemorrhage would ensue when the vessel is finally severed by the ligature.

Ligatures are made of chromicized or ordinary catgut, twisted silk, and floss silk.

The knots employed are the surgeon's knot for vessels of small or medium size, and the stay knot of Ballance and Edmunds for arteries of larger calibre. This knot consists of two or more ligatures applied side by side. On each one of them an ordinary single knot with two turns is made and the ends laid down. A similar knot is then tied on the other ligatures. The ends of both ligatures are then taken together and drawn upon equally, and the second knots tied as though they were but one thread. If there are multiple ligatures they are *tied in pairs. The two ends* are fastened together and the ends are cut off short. The intima are thus brought in apposition without rupturing the internal and middle coats.

FIG. 96.



The "Stay Knot" of floss silk. A, first stage; B, completed.
(*Ballance and Edmunds.*)

When the main artery of a limb is ligated, the extremity should be wrapped in cotton, after dressing the wound antiseptically, and kept at absolute rest. Splints should be employed if necessary.

The instruments needed for these operations are: scalpel, grooved director, retractor, aneurism needle, scissors, dissecting forceps, and hæmostatic forceps.

LIGATION OF SPECIAL ARTERIES.

THE FACIAL ARTERY.

This artery may be readily tied by cutting through the skin, platysma, and fascia at the point where it turns over the jaw at the anterior border of the masseter; for this purpose an incision one inch in length in the line of the artery is made, and the superficial fascia and fibres of the platysma divided on the director, when the artery and vein outside will be exposed to view.

But this operation can hardly ever be necessary, as a small harelip pin may be easily passed under it without an incision and a twisted silk suture passed over it.

THE OCCIPITAL ARTERY.

This is the first branch of the external carotid artery arising from the posterior part; it passes backward beneath the posterior belly of the digastricus, the trachelo-mastoid, and sterno-mastoid muscles to the occipital groove in the mastoid portion of the temporal bone.

Divide the skin one and a half inches in length over the course of the artery from the mastoid process of the temporal bone to the external occipital protuberance. The artery will be exposed when the fascia, aponeurosis of the sterno-mastoid muscle, and the splenius capitis muscle have been divided. The vein lies on the outside, and must be avoided when the ligature is applied.

TRIANGLES OF THE NECK.

Before attempting to ligate the arteries of the neck the student should thoroughly master the triangles. A synopsis of these, with their contents, is here presented :—

The great anterior triangle is bounded above by the body of the lower jaw, in front by the middle line of the neck, and behind by the sterno-mastoid muscle. It is subdivided into three minor triangles—

1. **The submaxillary triangle**, formed by the two bellies of the digastricus muscle and the inferior border of the lower jaw. *The submaxillary gland* is situated in the posterior angle of the submaxillary triangle. It is separated from the parotid gland by the stylo-maxillary ligament, and from the sublingual by the mylo-hyoideus muscle. Imbedded among its lobules is the facial artery and the submaxillary gland.

2. **The superior carotid triangle** is formed by the posterior belly of the digastric muscle, the upper belly of the omo-hyoid, and the sterno-cleido-mastoid. This triangle contains the upper portion of the common carotid artery and its bifurcations into the external and internal carotids; the superior thyroid, and the commencement of the lingual arteries; the internal jugular vein, and a chain of lymphatic glands; the descendens noni nerve in front of the sheath of the carotid, the pneumogastric within and the superior laryngeal and sympathetic behind. The lingual nerve crosses the upper angle.

3. **The inferior carotid triangle** is bounded by the superior belly of the *omo-hyoid muscle, the* sterno-mastoid muscle, and the middle line of the neck. *In this triangle is found the* lower part of the common carotid artery and jugular

vein, descendens noni, pneumogastric and sympathetic nerves, and recurrent laryngeal nerve.

The great posterior triangle is bounded in front by the sterno-mastoid, behind by the border of the trapezius muscle, and below by the clavicle. It is subdivided into two minor triangles by the inferior belly of the omo-hyoid muscle: (1) the *suboccipital* and (2) the *subclavian* triangles.

1. **The suboccipital triangle** is situated above the omo-hyoid, and contains the suboccipital nerve at its upper angle and the spinal accessory nerve and branches of the cervical plexus below.

FIG. 97.

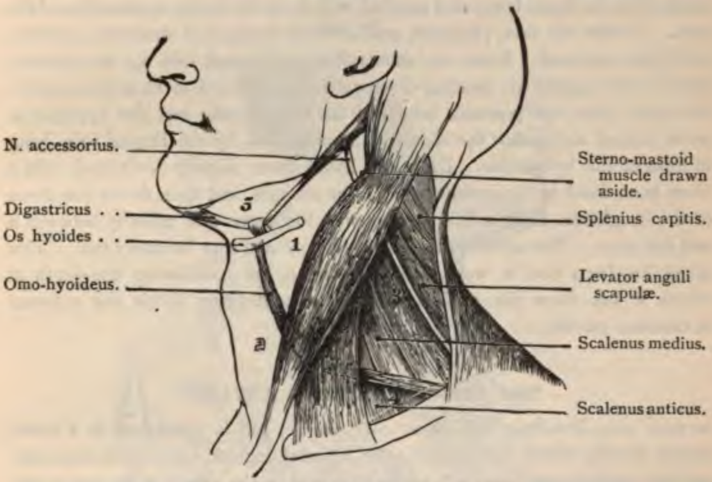


DIAGRAM OF TRIANGLES OF THE NECK.

1. Superior carotid triangle.
2. Inferior " "
3. Occipital triangle.
4. Supra-clavicular triangle.
5. Submaxillary triangle.

2. **The subclavian triangle** is bounded in front by the sterno-mastoid, behind by the inferior belly of the omo-hyoid, and below by the clavicle.

The subclavian triangle contains the termination of the external jugular vein, the third part of the course of the subclavian artery, and the brachial plexus of nerves, and is crossed by the posterior scapular artery.

THE LINGUAL ARTERY.

This artery is usually tied in the triangle bounded by the anterior and the posterior belly of the digastricus, and by the inferior border of the lower jaw. At this place it is covered by the skin, platysma, cervical fascia, submaxillary gland, and the hyoglossus muscle.

The guides are the hypoglossal nerve above the vessel, the anterior border of the digastric tendon and the great horn of the hyoid bone below the artery.

To perform this operation the head is drawn over to the opposite side; a curved incision is made, two-thirds of an inch above the junction of the greater cornu with the hyoid bone, and parallel with it, as far as the median line of the neck. Divide the skin, platysma, and cervical fascia, and draw the posterior facial vein outward. Raise the submaxillary gland and look for the posterior belly of the digastricus; passing downward and forward to its attachments to the hyoid bone, the posterior border of the mylo-hyoid; and the hypoglossal nerve behind and below the digastric, accompanied by the lingual vein lying in front of the hyoglossus. Draw the hyoid bone slightly downward, with a blunt hook fixed in the lower angle of the triangle, and then divide the fibres of the hyoglossus along a line parallel with the nerve and midway between it and the bone. The artery will then be in sight and can be easily tied. This artery has been tied in wounds of the tongue, but considering the depth at which it lies from the surface, it is considered better to tie the external or common carotid.

THE COMMON CAROTID ARTERY

on each side lies upon the *longus colli* muscle, and is contained in a dense areolar sheath, which also includes the internal jugular vein on its outer side and the pneumogastric nerve between; in front of the sheath is the *descendens noni* nerve; behind the sheath lie the sympathetic and cardiac nerves. At the lower part, the inferior thyroid artery and recurrent laryngeal nerve cross behind it toward the larynx. The line of the artery is from the sterno-clavicular articulation to a point midway between the angle of the lower jaw and the tip of the mastoid process. The artery bifurcates on a level with the top of the thyroid cartilage, except in long-necked women, when it usually is found somewhat below this point.

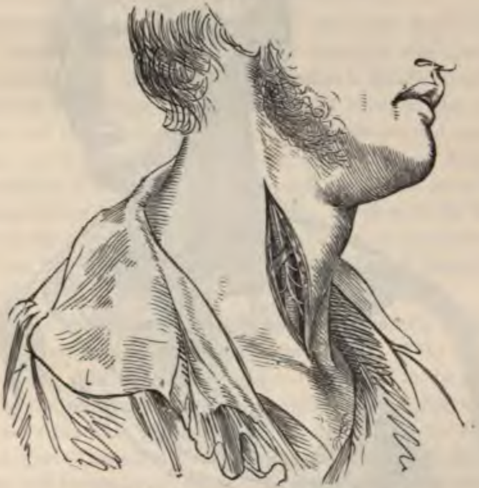
The left common carotid arises from the arch of the aorta, and rests first on the side of the trachea, œsophagus, and thoracic duct; the left jugular vein lies rather in front of the carotid, as it joins the left brachio-cephalic vein.

The right carotid arises from the *arteria innominata*, behind the sterno-*clavicular articulation*, and ascends more perpendicularly. Both arteries divide into internal and external carotids opposite the upper border of the thyroid cartilage in the male, and in the middle of the thyroid cartilage in the female.

At the lower two-thirds each artery is covered by the sterno-mastoid, sterno-hyoid, and sterno-thyroid muscles, and is crossed by the omo-hyoid, opposite the cricoid cartilage. At the upper part of its course the artery is covered only with skin, fascia, and sheath; upon the last lies the *descendens noni* nerve.

To tie the common carotid in its lower part in the inferior carotid triangle the patient must be placed on his back, with shoulders raised, head thrown back and slightly turned toward the opposite side; an incision three inches in length

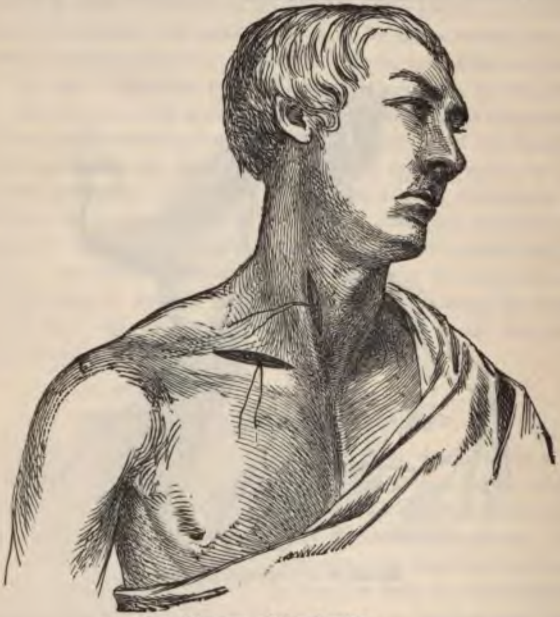
FIG. 98.



Relations of Common Carotid.

is made on the line of the artery, the inner margin of the sterno-mastoid muscle being the guide; this incision should extend from opposite the thyroid cartilage to the sternum, and must be carried through skin, platysma, and superficial fascia. The sterno-mastoid must now be relaxed by turning the head to the side operated on; now expose the edge of the sterno-mastoid, and look for and avoid the external jugular vein; separate and draw outward the sterno-mastoid, and draw inward the sterno-hyoid and sterno-thyroid muscles. Scratch through the dense fascia which unites the omo-hyoid in the sheath, when the latter will be seen with the branches of the *descendens noni* upon it; this must be drawn aside. The sheath must be pinched up with the forceps and opened with a careful touch of the knife, its flat surface toward the artery. Enlarge the aperture on a director, detach the artery from its connections for a limited extent, with a probe and an aneurism needle, which, armed with a double ligature, is passed around the vessel from without inward; avoid the vagus nerve, by keeping the point of the needle close to the vessel. When the point appears on the inner side seize the ligatures with the forceps, and withdraw the needle; ascertain that the nerve is not included in the ligatures, and tie them with the stay knot.

FIG. 99.



Ligature of the Carotid.

To tie the common carotid in its upper part in the superior carotid triangle, the patient is placed on his back, head thrown back; an incision three inches long is made through the skin and platysma, on the anterior edge *of the sterno-mastoid* muscle, from a little below the corner of the lower jaw to *opposite the cricoid cartilage*. The deep fascia is now pinched up, opened, and carefully divided; the edges of the wound are then to be drawn asunder; next feel for the pulsation of the artery; open the sheath over it, care being taken to get on the inner or artery side of the septum, between the artery and vein; do not include the *descendens noni* in front of the vagus and sympathetic nerve behind. Expose but a small portion of the artery, and pass the aneurism needle from without inward.

THE EXTERNAL CAROTID ARTERY.

Owing to its numerous branches and anatomical complications, except when wounded, this artery is seldom ligated. It may be tied either near its point of origin or above the posterior belly of the *digastric muscle*.

Ligation Near the Point of Origin.—The line is the same as that given for tying the common carotid. The shoulder should be raised and the head turned to the opposite side. An incision three inches in length should be made downward opposite the greater cornu of the hyoid bone, on the line of the vessel and along the anterior border of the sterno-cleido-mastoid muscle; then carefully divide, on the director, the platysma, superficial and deep fascia in turn, when the sheath of the vessel will be brought into view; seize this with a pair of dissecting forceps, lateralized, and open the sheath with the back of the knife, laying bare the artery. The aneurism needle is then passed from without inward, great care being taken to avoid the internal carotid artery, which lies external and behind.

Ligation Above the Posterior Belly of the Digastric Muscle.—An incision is made from the lobe of the ear to the junction of the greater cornu with the hyoid bone. The same structures are divided and in the same manner as when ligating the vessel near its point of origin, but in cutting down on the sheath numerous veins that will be found in the path of the surgeon may require the protection of a double ligature before proceeding with the operation; necessarily some will be wounded; when this occurs they must be at once caught with the hæmostatic forceps and secured by ligature. At the bottom of the wound will be found the posterior belly of the digastricus, together with the stylo-hyoid muscle; these are to be separated from the parotid gland, which is above, when the artery will be found just before it enters that structure, and can be easily tied.

ARTERIA INNOMINATA.

The patient is to be placed on his back, with shoulders raised and head thrown back; an incision two and a half inches in length is to be made along the inner margin of the sterno-mastoid, terminating at the clavicle, and another across the origin of that muscle, meeting the former at an angle; the flap thus formed is to be turned up, and the sterno-mastoid divided at the sternal and part of the clavicular origin. Turn aside the areolar tissue and fat, and divide the sterno-hyoid and thyroid muscles. Scratch through the strong fascia, which is next presented, very cautiously; then trace the carotid carefully, with the finger, to its origin. The vena innominata must then be held down with a spatula, and a ligature, carried *from without inward*, must be brought around the artery, close to its bifurcation, care being taken to avoid the vagus, recurrent and cardiac nerves, and pleura.

THE SUBCLAVIAN ARTERY.

The ligation of the first and second parts of the artery is rarely performed. In the *third part* of its course it is about one and a quarter inches long, and passes from the outer border of the *scalenus anticus*, downward and outward, under the clavicle, to the lower border of the first rib, where it becomes the axillary. To locate the artery at this portion, divide the clavicle into thirds; under the centre of the middle third it will be found.

Ligation of the Third Part.—The patient must be laid on a table, with the shoulder of the affected side drawn downward and forward, and the head turned to the other side. An incision from three to four inches long is then made, half an inch above and parallel with the clavicle. In order to avoid the external jugular vein draw the skin down over the clavicle. An incision is then made directly upon the upper margin of the clavicle down to the bone, extending from the outer margin of the sterno-cleido-mastoid muscle to the inner border of the trapezius muscle. By drawing the integument well down over the clavicle, the external jugular vein is retracted underneath the clavicle, thus escaping injury. When all the tissues are divided to the bone the integument is allowed to assume its normal position, and the line of the incision will be found to be about one-half inch above the clavicle, and directly over the course of the artery. It must cut through the skin and platysma, and extend from the outer edge of the sterno-mastoid to the trapezius. The external jugular, now exposed, must be drawn aside with a blunt hook; it is generally more convenient to draw it to the inner side, or it may become necessary to ligate and cut it. The clavicular portion of the sterno mastoid must be divided. The fascia must now be carefully divided, tearing it with the forceps if possible. The omo-hyoid is to be drawn up.

The anterior scalenus having been traced to its insertion in the rib, the pulsations of the artery will then be felt by turning the pulp of the finger outward, when the surrounding areolar tissue must be carefully torn through. Care must be taken to avoid the lower trunks of the brachial plexus of nerves, which may appear first; the cessation of the pulse at the wrist, when the trunk is pressed by the finger, is good evidence that it is the sought-for vessel, and not a nerve. Venous hemorrhage, if troublesome, and cannot be controlled by pressure, must be stopped by tying the veins.

The ligature must be carefully passed *from below upward.*

THE AXILLARY ARTERY

extends from the lower border of the first rib to the lower end of the *teres major*, in the axilla ; surgically it is divided by the pectoralis minor into three parts ; the first part extends from the lower border of the first rib to the posterior border of the pectoralis minor, the second lies under the muscle, and the third extends from the anterior border of the pectoralis minor to the teres major.

To tie the artery in the first part, below the clavicle, the shoulder and arm must be drawn back, so as to form an angle of 80°, and put the pectoral muscles on the stretch; an incision, four inches long, is then to be made from the coracoid process inward, in a transverse depending curve, half an inch below the clavicle. The clavicular fibres of the *pectoralis major* are then to be divided to the same extent; the lower border of the wound is then to be drawn downward, the costo-coracoid membrane cut through, when the edge of the *pectoralis minor* will be readily seen, crossing upward and outward over the vessels and nerves. Wounded branches of arteries should at once be tied.

To relax the *pectoralis major*, the arm should now be brought to the side; a few scratches with a director will expose the axillary vein, which should be held inward. Then seek for the beating of the artery, which must be carefully isolated, and an aneurism needle passed from without inward.

The nerves lie on the outside and behind, and care must be taken not to include them with the artery.

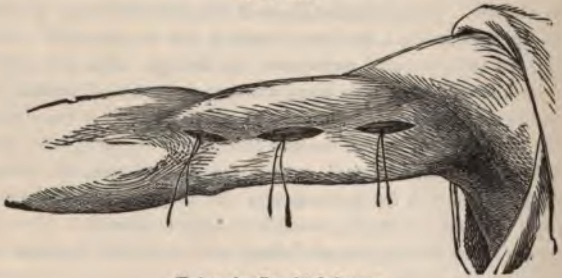
To tie the axillary artery in the third part, that is, in the armpit, the patient is placed on his back, the arm placed at right angles with the trunk, the forearm being flexed upon the arm. The axillary vessels and nerves lie between the *pectoralis major* in front and the *latissimus dorsi* and *teres major* behind, and can be readily felt against the upper end of the humerus, the *coraco-brachialis* and biceps being placed externally, and are the guides to the vessel. To locate the vessel at the point where the ligation is to be performed, draw a line from the great pectoral to the latissimus dorsi; divide it into thirds; the vessel will be found at the junction of the anterior and middle third.

The operator makes an incision, two and a half inches long, parallel with the end of the humerus, on the line of the artery; he then dissects carefully through the fascia, until the basilic, axillary vein, and median nerve are revealed; the veins are to be drawn inward and the nerve outward, the artery being found between them, and is exposed by tearing with the forceps and director. Care is to be taken not to wound the thoracic and subscapular veins. The aneurism needle is passed between the vein and artery.

THE BRACHIAL ARTERY

passes obliquely down the inner side of the humerus to the middle of the bend of the elbow; it runs along the inner borders of the *coraco-brachialis and biceps*, which form the guides to it. It is accompanied by two *venæ comites* and is encircled by their numerous branches; it is likewise accompanied by the *median nerve*, which first lies on its outer side, between it and the *coraco-brachialis;* then crosses over it, and is quite internal to it at the elbow. A line drawn from the junction of the anterior and middle third of the "axillary line," (*i. e.*, from the great pectoral to the latissimus dorsi), to a point midway between the condyles of the humerus, indicates the course of the artery.

FIG. 100.



Tying the Brachial Artery.

To tie the brachial at its upper third, the limb must be drawn from the side and supinated. The operator identifies the *coraco-brachialis*, and feels the pulsation of the artery; he then makes an incision, three inches in length, over the artery, opposite the middle of the *coraco-brachialis;* divides the fascia to the same extent; the basilic vein will probably be found to the inner side of the artery. The forearm may now be bent, to relax the parts, and the muscles, if in the way, must be drawn aside, the sheath of the artery opened, and the median nerve drawn aside. Having identified the artery, by its pulsation or the appearance of its coats, the needle must be passed in whatever direction the operator finds most convenient.

***To tie the brachial* artery in the middle of the arm**, the incision is to *be made along* the inner side of the biceps, at the *insertion* of the *coraco-*

brachialis muscle. The median nerve usually lies over the vessel, and must be drawn aside; the biceps being well relaxed, the needle should be passed from within outward.

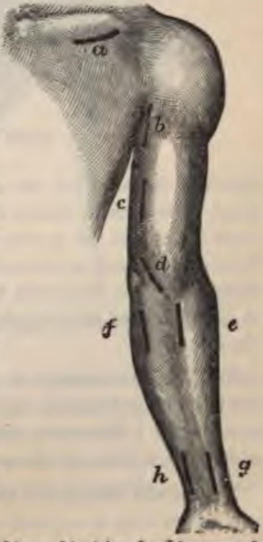
To tie the brachial artery in its lower third, an incision, from two and a half to three inches long, should be made obliquely, about half an inch internal to the tendon of the *biceps*, first ascertaining its positon; and the median basilic vein, if in the way, must be held aside, passing the ligature needle *from the median nerve.*

THE RADIAL ARTERY.

This artery may be tied in any part of its course.

Ligation in the Upper Third.—The "line" of the artery is from the middle of the bend of the elbow to the ulnar side of the styloid process of the radius. The nerve lies to the radial side of the artery. The artery in its upper third lies between the *pronator radii teres* and the *supinator longus*, and is overlapped by the last named muscle; it is accompanied by the *venæ comites.*

FIG. 101.



Lines of incision for Ligature of Arteries of the Upper Extremity. (*Walsham.*)

To tie the artery the forearm must be held in the supine position; an incision from two and a half to three inches long must be made over its course at an angle of five degrees to the line of the vessel, and in the direction *from without inward.* The skin, superficial and deep fascias being divided, the muscles are turned aside with the handle of the knife, and the artery having been separated from the *vena comites*, the ligature needle is passed around it from without inward.

In the middle third the same line is used and same length of incision is made as in the upper third. The artery lies between the *supinator longus* and the *flexor carpi radialis* muscles, which are separated as already directed, when the vessel is tied.

In the lower third the artery lies between the same muscles as the middle third, and the mode of ligation is precisely similar, except that the operation is performed nearer the wrist.

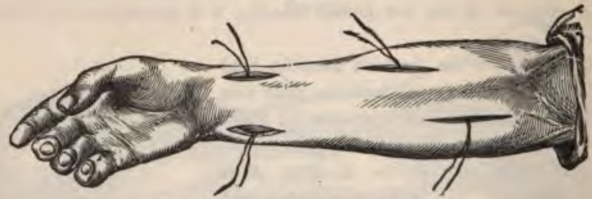
To tie the radial artery on the outer side of the wrist, over the "snuff box," an incision is to be made through the skin, from opposite the styloid process of the radius to the commencement of the first interosseous space. The guide to the artery is the *extensor secundi internodii pollicis*, which crosses the artery before it dips into the palm. The incision should be two inches long. The ligature is to be applied on the ulnar side of the tendon.

THE ULNAR ARTERY.

As a rule, this artery is only tied in its upper third for wounds. The course of the vessel is oblique from without inward.

To Tie the Artery in the Upper Third.—The "line" of the vessel is from the middle of the bend of the elbow to the junction of the upper and middle third of the shaft of the ulnar. An incision should be made at a point two and a half inches below the internal condyle of the humerus, and one-third the width of the arm from the inner edge, extending downward about three inches; divide the skin and fascia, find the septum of the *flexor carpi ulnaris* on the inside, and the *flexor sublimis digitorum* on the outside. Incise the septum, separate the superficial muscles from the *flexor profundis digitorum;* the artery will be found lying on this muscle. The ulnar nerve should be looked for as a guide to the artery; *the needle should be passed from the nerve.*

FIG. 102.



Tying the Radial and Ulnar Arteries.

To Tie the Artery in the Middle.—A line drawn from the internal condyle of the humerus to the radial side of the pisiform bone covers the ulnar artery. The artery will be found between the *flexor carpi ulnaris* and *flexor sublimis digitorum.*

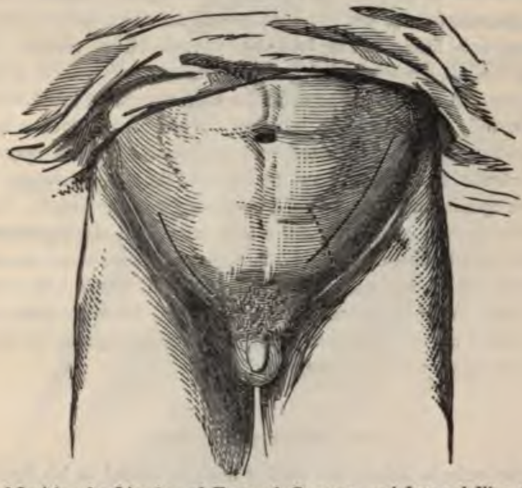
To tie the artery in the lower third, or above the wrist, an incision two inches long is required on the same line as that given for reaching the vessel at its middle portion. The incision should be made three-quarters of an inch from the ulnar edge of the limb and just external to the flexor carpi ulnaris. After the skin and fascia have been divided, the artery will be found covered by the tendon of the flexor carpi ulnaris, which is internal, and the flexor sublimis digitorum, which is external.

The venæ comites having been separated, the needle is passed *from the nerve*, which lies on the ulnar side of the artery.

THE COMMON ILIAC ARTERY.

To tie this artery, make a slightly curved incision, six inches in length, the lower third being about two inches above Poupart's ligament, and parallel with it. Divide the muscles and tear through the transversalis fascia; gently repress the intestines upward, which will protrude through the wound, and separate the peritoneum from the iliac fossa. When the brim of the pelvis is reached, seek the external iliac, which is a guide to the common trunk. Open the sheath just above the bifurcation and, if possible, pass the needle from within outward.

FIG. 103.



Lines of Incision for Ligation of External, Common, and Internal Iliac Arteries.

THE EXTERNAL ILIAC ARTERY

lies on the inner border of the psoas muscle, the vein being on the inner side and below. The genital branch of the *genito-crural* nerve lies on it for a short distance. The artery is invested by the peritoneum, and high up is crossed by the sigmoid flexure of the colon on the left side, and by the ilium on the right side; the ureter is near its division. Low down it is crossed by the spermatic cord in the male and the round ligament in the female, and is crossed by the *circumflex iliac* vein.

To tie the external iliac the patient must be placed flat on a table, so that the abdominal muscles may be rendered tense. Make an incision, three and a half or four inches long, above and parallel to Poupart's ligament, beginning about half an inch outside the external abdominal ring; carry it through the skin and superficial fascia, and lay bare the external oblique tendon. Then cut through this tendon, the *internal oblique*, and *transversalis muscles* to the extent of the incision. A portion of the muscular fibres should be lifted with the forceps and carefully cut through, to form an opening, into which a broad, flat, grooved director must be insinuated, and the muscle divided upon it to the necessary extent. Now gently draw the edges of the wound asunder with bent spatulæ; the opening must be enlarged by tearing with the fingers. Then carefully strip the peritoneum off from the iliac fossa until the finger reaches the artery. The sheath must be scratched through with forceps and director at the point selected, and the artery separated from the vein, which will be found *on the inner side;* the aneurism needle is then passed between them, excluding the *genito-crural* nerve. The wound must be brought together by sutures, and the trunk bent forward, to relax the muscles.

THE SCIATIC ARTERY.

To tie the sciatic artery the patient must be placed on his face, with his toes turned inward; make an incision four inches long, from two and a half inches below the posterior spinous process of the ilium, an inch from the *sacro-iliac* joint toward the great trochanter. The fibres of the *gluteus maximus* must be separated for the same extent, and having arrived at the strong fascia, beneath the muscle, the vessel will be found emerging from the sciatic notch; the nerve and vein must be carefully avoided.

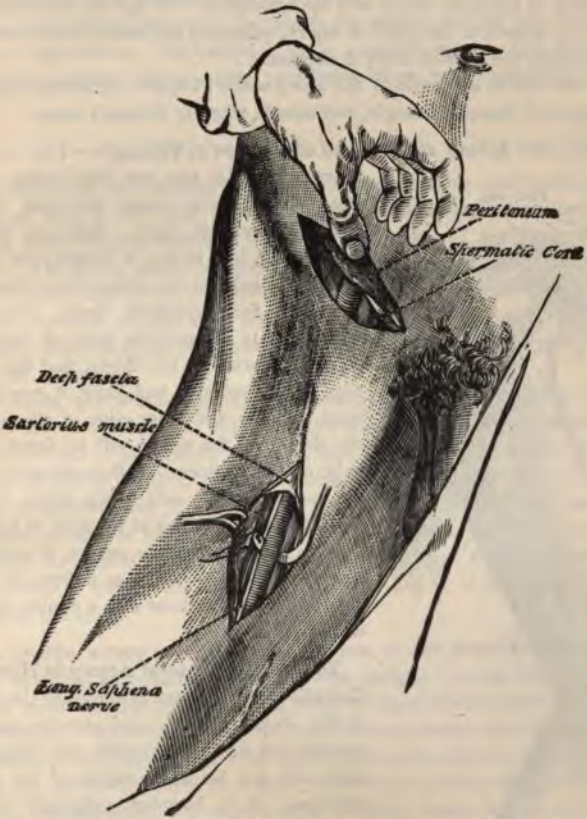
The gluteal artery may be found by making the same incision, but one inch and a half higher up; be careful to avoid the nerve and vein.

These operations are exceedingly difficult, but are justified in the case of *wounds.*

THE FEMORAL ARTERY.

The course of the femoral artery is indicated by a line drawn from the middle of Poupart's ligament in the male, and a quarter of an inch toward the symphysis pubis in the female, to a point midway between the inner edge of the patella and the internal condyle of the femur, when the knee is bent and the thigh turned outward.

FIG. 104.



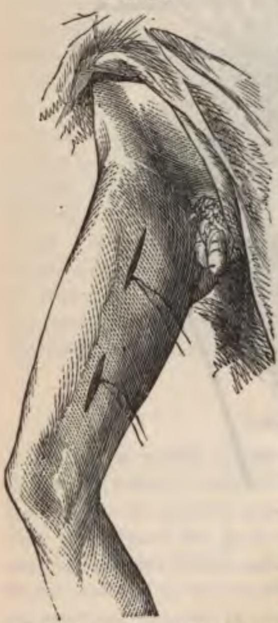
Ligature of External Iliac and Superficial Femoral Arteries. In this figure the incision for the Femoral Artery is placed too low. (*Moullin.*)

The artery may be ligated at any portion of its course; the points of selection are the apex of Scarpa's triangle and in Hunter's canal. If possible the ligature should not be applied near the point of bifurcation, that is to say, where the common femoral divides into superficial femoral and profunda femoris. The reason has already been given. It is preferable to tie the external iliac rather than to ligate the artery near the bifurcation. If the vessel be wounded, it is to be secured at the point of injury, enlarging the wound in the tissues in order to reach the injured artery if necessary.

The vein lies to the inside of the artery under Poupart's ligament, behind it at the apex of Scarpa's triangle, and outside when in Hunter's canal.

To Tie the Artery at the Apex of Scarpa's Triangle.—The centre of Scarpa's space is two and half inches below Poupart's ligament, hence the apex is five inches below that point. Make an incision three and a half inches in length, the centre of which should be five inches below Poupart's ligament; the superficial fascia should be divided on a director, the sartorius being relaxed by abducting the thigh; find the inner edge of the sartorius and draw it gently outward. Under the inner edge of this muscle the sheath of the artery will be found; it is to be cautiously opened, sufficiently so to admit the needle, great care being taken not to transfix the vein, which at the apex of Scarpa's triangle is underneath the artery; to avoid this use a blunt needle and pass it from the inner side. Tie the stay knot with a double ligature of floss silk.

FIG. 105.



Lines of Incision for Ligature of the Superficial Femoral Artery.

To Tie the Femoral Artery in Hunter's Canal.—Hunter's canal is formed by the fascias of the *abductor longus* and *abductor magnus* muscles, extending downward and inward to unite with the tendinous origin of the vastus internus. It is bounded externally by the vastus internus, and internally by the abductor magnus and the abductor longus muscles; it is triangular in shape and from one and a half to *two inches in length,* and is situated at the junction of the middle and lower *third of the thigh.*

To tie the artery, flex the leg and abduct the thigh. Make an incision four inches in length, the centre of which will be directly at the junction of the middle and lower third of the thigh, on the line laid down for tying the artery higher up. Divide in turn the skin, superficial fascia, and deep fascia; search for the outer border of the sartorius muscle, which must be separated and drawn inward, when the canal will be exposed.

The canal contains the artery, the vein to the outside, and the long saphenous nerve to the outside. The sheath is to be carefully opened, and the needle passed from without inward, great care being taken not to injure the vein or nerve.

THE POPLITEAL ARTERY.

The artery lies in a lozenge-shaped space, formed above and externally by the biceps and on the inner side by the semi-membranosus, semi-tendinosus, gracilis, and sartorius muscles, below by two heads of the gastrocnemius muscle. The artery passes through this space from the side toward the internal to the external condyle; as it crosses the joint it lies in close contact with the posterior ligament of the knee joint. Its depth from the surface and the numerous branches given off render it inexpedient to tie it at this point except in case of wound.

The points upon which to apply a ligature are either at the superior or inferior angle of the popliteal space. At the upper portion of the space the vein lies to the outer side of the artery; it crosses and lies immediately above it at the middle, and lies to the inner side of the vessel at the lower portion. Above the vein and separated from it by a mass of fat is the internal popliteal nerve; in the upper part of the space it is to the outside of the artery, which it crosses at its middle, and lies at the inner side at the lower portion; hence from without inward there is first the nerve, then the vein, and finally, at the very bottom of the space, the artery.

To tie the artery in the upper portion of the popliteal space, the patient is placed upon his face, with his knees straight and legs extended. An incision three inches in length is made along the semi-membranosus. The skin, superficial and deep fascia are carefully divided, employing the director, when the border of the semi-membranosus will be presented; draw it to one side and expose the nerve, which is to be carefully separated from the vein underneath by an Allis dry dissector; the vein is then carefully drawn to one side, when the artery will be found below, to the inner side. The needle is to be passed from without inward.

To tie the artery in the lower third, a three-inch incision is made in the middle line between the heads of the gastrocnemius, and the skin, superficial and deep fascias are divided, care being taken not to wound the external saphenous vein; the nerve first, then the vein, and finally the artery will be found *in situ*, as described in the ligation of the upper third. Flex the leg slightly, so as to relax the gastrocnemius, carefully separate the nerve and vein, and pass the aneurism needle from without inward.

THE POSTERIOR TIBIAL ARTERY.

To tie the posterior tibial, the patient should lie on his back, with the limb lying on its outer side, the knee half bent, and the foot extended on a pillow. A line drawn from the middle of the popliteal space to a point just behind the inner edge of the internal malleolus indicates the course of this artery.

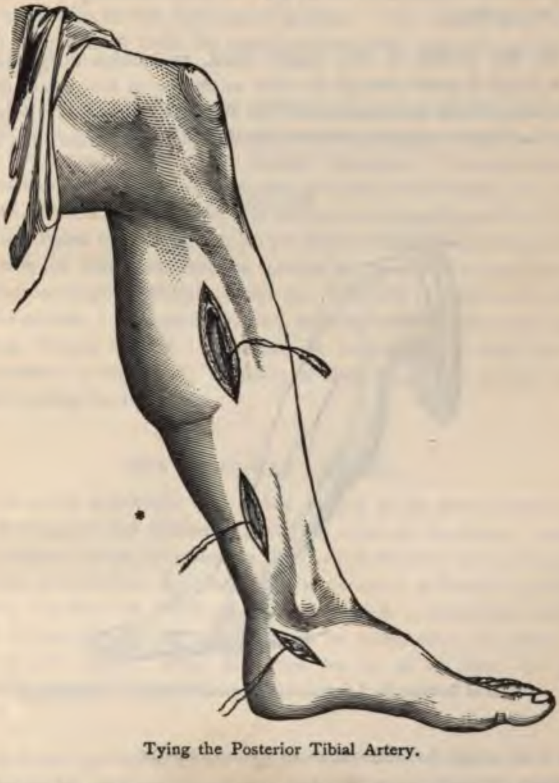
To tie the artery in the upper third, an incision four inches long, half on the upper and half on the middle third of the leg, and an inch from the inner edge of the tibia, should be made through the skin and superficial fascia. Avoid the *saphena* vein. Divide the deep fascia, expose the muscles, and draw aside the *gastrocnemius;* expose the *soleus*, which is to be divided with great care at right angles to the inner edge of the tibia and to the whole length of the wound. The muscular fibres are cut through until the operator recognizes the tendinous origin of the soleus, which is to be lifted up with the dissecting forceps, divided on a director, when the artery will be discovered lying under the tibia and on the tibialis posticus muscle. The two veins are in very close contact; the nerve is superficial to the artery, and frequently to the outer side. A good rule whereby to recollect its position is that the nerve lies between the artery and the table. Pass the ligature from without inward.

To tie the posterior tibial in the middle of the leg, make an incision, three inches long, in the middle and lower third of the leg, half-way between the inner edge of the tibia and the inner border of the *tendo-Achillis*. Divide the fascia. The artery, surrounded with fat, accompanied by two veins, will be found along the inner edge of the *flexor longus digitorum;* the nerve is on the outer side. In the upper part of the leg, the posterior tibial nerve lies to the inner or tibial side of the artery; it passes over it about the middle, and inferiorly it lies to its outer or fibular side. Pass the ligature from without inward.

To tie the posterior tibial in the lower third, make an incision, three inches in length, on the line of the artery, dividing the skin, superficial and deep fascias; push outward the inner border of the tendo-Achillis, when the vessel will be found on the inner edge of that tendon; the nerve lies to the tibial side. Pass the ligature from without inward.

To tie the posterior tibial at the ankle, make a slightly curved incision, two and a half inches long, in the groove, half way between the hinder edge of the internal malleolus and the extremity of the heel, commencing near the tendo-Achillis; divide the superficial fascia, the dense fibres of the internal annular ligament, which adheres to the sheaths of tendons and covers the vessels and nerves, and the artery will be found with its venæ comites. The ligature is to be passed from below upward, avoiding the posterior tibial nerve.

FIG. 106.



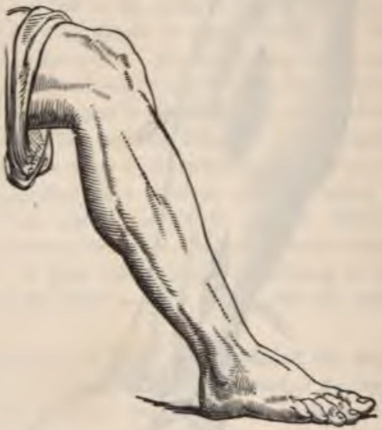
Tying the Posterior Tibial Artery.

ANTERIOR TIBIAL ARTERY.

This artery may be ligated in any part of its course. The line of the artery is indicated by taking a point midway between the head of the fibula and the crest of the tibia, dropping an inch, and from thence drawing a line to midway between the malleoli.

To tie the artery in the upper third, an incision three and a half inches in length is made through the skin on the line of the vessel; the superficial and deep fascias are then divided and the muscles exposed; the artery lies between the tibialis anticus and the extensor longus digitorum; the muscular space is to be sought for, and will be recognized by observing that it is the first from within outward; move the foot and four lesser toes, which will bring into action the muscles, which will guide to the artery. Separate the muscles with the handle of the knife and the artery will be seen on the interosseous membrane; the nerve, accompanied by venæ comites is on the outer side. Separate the veins from the artery and pass the ligature from without inward.

FIG. 107.



Lines of Incision for Ligature of the Anterior Tibial. (*Moullin.*)

To tie the artery in the middle, make an incision three inches in length in the line of the artery, dividing the skin, superficial and deep fascias. The artery is usually found between the tendons of the extensor proprius pollicis and the extensor longus digitorum; if not found in this position, look for it between the tendons of the tibialis anticus and the extensor proprius pollicis, as it is frequently in the last-named position. The artery here is quite superficial. Separate it from the venæ comites and pass the ligature from without inward.

To tie the artery in the lower third the incision should be three inches long on the line of the artery from the external border of the tibialis anticus muscle to the margin of the anterior annular ligament. The superficial and deep fascias should be divided on a director, and the artery sought for between the tendons of the tibialis anticus and the extensor proprius pollicis. If the artery be not found in this position, do not further interfere with the surrounding structures, but search between the tendons of the extensor proprius pollicis and the extensor longus digitorum, where the vessel will be discovered, with the nerve to the outside. Separate the artery from the venæ comites and pass the needle from without inward. It should be borne in mind that the vessel in this situation is superficial, therefore a deep dissection should not be made when looking for the artery.

THE PERONEAL ARTERY.

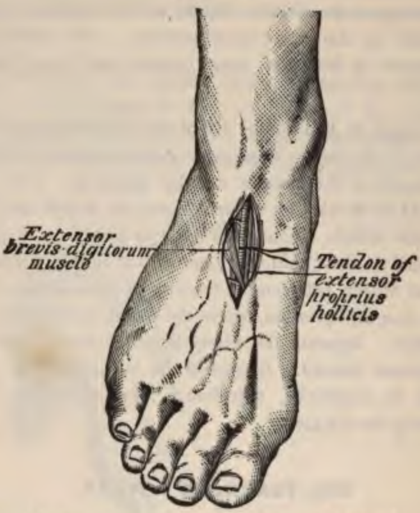
To tie this artery an incision four inches long is to be made, almost in the centre of the leg, an inch behind the external edge of the fibula. Find the *soleus* and separate it from the peronei which encircle the outer side of the fibula; to expose the *flexor longus pollicis* it may be necessary to detach a portion of the peronei, the fibres of which must be separated longitudinally with the handle of the scalpel, and the artery should be found about the centre, near the edge of the fibula. Bend the great toe so as to relax the *flexor longus pollicis* when it is exposed.

THE DORSAL ARTERY.

The course of the artery is indicated by a line drawn from the middle of the malleoli to the middle of the first interosseous space. The vessel lies very superficially, the incision, therefore, should *not extend below the upper point of the first interosseous space.*

The incision should be two inches in length, dividing the skin; the superficial and deep fascias should be divided on a director, when the artery will be found between the tendons of the extensor proprius pollicis on the inside and the inner border of the extensor brevis muscle on the outside. The nerve accompanies the artery on the outside. Separate the venæ comites and pass the needle from without inward.

Fig. 108.


Extensor brevis digitorum muscle
Tendon of extensor proprius pollicis

Ligature of Dorsalis Pedis Artery. (*Moullin.*)

URINARY CALCULI.

Urinary calculi are found in four different situations in the urinary organs; in the kidney, ureter, bladder, and urethra.

A precipitate let fall from the urine after it has been voided is called a *sediment;* when precipitated in the bladder or kidneys it is called *gravel;* and gravel lodging in any part of the urinary passages may concrete into *stone.* When the urine habitually presents any one kind of deposit, the patient is said to have a corresponding *diathesis*, as the lithic diathesis, etc.

The lithic or uric acid, or red gravel, is deposited in the form of minute crystals, tinged with the coloring matter of the urine.

The *lithates of ammonia, soda* and *lime*, form a very common sediment, varying in color from nearly white to dark red. Urine generally acid.

Oxalate of lime is generally deposited from urine which is acid and contains much lithate.

Phosphatic deposits may arise from excessive secretion of the mucus of the bladder, or from a primary alkaline or insufficiently acid state of the urine.

When a patient is secreting the red crystalline gravel, or has a *fit of the gravel*, as it is called, he generally complains of great pain in the loins and bladder, frequent desire to make water, and aching of the testicles and hips; sometimes there is feverishness, with languor and dyspepsia.

Treatment.—The patient should be treated on general principles: if he is lusty, with red lips, has been living highly, and has not been long an invalid, he will generally be relieved by purgation, a reduced diet, warm baths, and liq. potassæ, in doses of ʒj, thrice daily, after meals. Exercise, temperance, and restricted diet will correct this diathesis.

But if the urinary deposit is caused by feebleness of the powers which ought to convert food into healthy flesh and blood, or by overwork, the treatment should begin with judicious purgation, with change of diet and air, and a persistent tonic course; nitro-muriatic acid may be given with benefit; quinine, nux vomica, muriated tincture of iron, etc.

Various Kinds of Stone.—The chief varieties are the lithic, phosphatic, and mulberry.

Lithic or uric acid stones are generally oval, flattened, fawn or mahogany colored. This stone may be dissolved by boiling in liquor potassæ; it burns away under the blowpipe, and if digested in nitric acid, and evaporated at a very gentle heat, it leaves a residue which, when cold, becomes purple, if exposed to the vapor of ammonia.

Triple phosphate forms white or pale gray stones. When treated with liquor potassæ evolves ammonia; is soluble in acetic and muriatic acids.

The **mulberry stone** is composed of oxalate of lime. It is dark red, rough, and tuberculated. It is not dissolved by boiling in potassa; is soluble in nitric acid; exposed to the blowpipe, the acid is burnt off and quicklime is left.

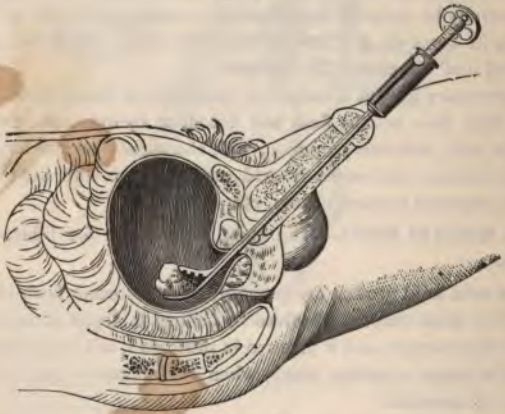
STONE IN THE BLADDER.

Symptoms.—Irritability of the bladder, with frequent irresistible desire to make water, occasional sudden stoppage of the stream of water during micturition, and the stream flowing again if the patient throws himself on his hands and knees, occasional pain at the ne[illegible]dder, pain in the glans penis, and frequently passage of blood a[illegible] acid or oxalate with the urine; if a child, there will be elongation of prepuce, from his attempting to alleviate his pain by pulling at the organ.

But to make sure of the existence of stone, a *sound* must be employed, when it will be made sensible to the touch and to the ear. The *sound* is a solid steel rod, of the size of the medium catheter; its handle is polished, and its shaft is smaller at the end, so as to move easily into the urethra. Sometimes the stone cannot be felt, either on account of an enlarged prostate, or because cysts or pouches exist in which the foreign body is hid.

The symptoms of stone vary in severity, according to its size and roughness, the state of the urine, or the condition of the bladder, whether healthy or inflamed.

FIG. 109.



Lithotrity.

Treatment.—The indications are to get rid of the abnormal condition of the urine, to allay pain and irritation, and to remove the stone. The first two measures have already been spoken of.

Lithotrity and *Lithotomy* are the methods pursued to remove the stone.

Lithotrity is an operation for crushing stone in the bladder into fragments of so small a size that they may readily be expelled through the urethra; the instrument generally used is the lithotrite of Bigelow.

The best cases are those with a urethra of full size, and a bladder neither irritable, contracted, nor paralyzed. The danger is in mechanical injury to the bladder.

The patient should be plac[illegible] on his back, on a couch, with his head on a pillow, knees gently raised and supported, and a little apart. The pelvis should be raised above the level of the shoulders.

The object is to get the stone away from the neck of the bladder. The bladder should hold from four to eight ounces of water. The instrument, warmed and oiled, is now to be gently introduced and passed fully into the bladder. The next step is to seize the stone; this is done by applying the instrument to the stone, so as to seize and lift it, by *rotating* the instrument upon the axis of its shaft. When the stone is fairly grasped, the screw is employed to crush it; at the end of the operation it must be seen that the blades are entirely closed and not choked by detritus, while the instrument is withdrawn.

Subsequently, pain must be relieved by opiates. Hip baths and demulcent drinks must be used to allay irritation. The operation must be repeated at intervals, till every fragment is crushed and expelled.

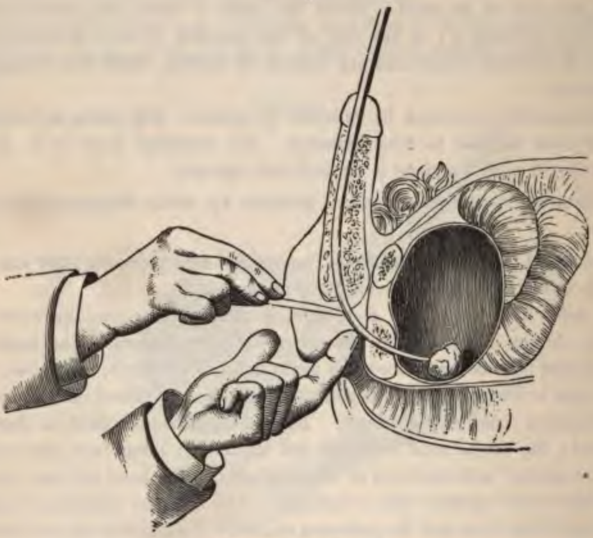
Lithotomy.—There are several methods by which lithotomy may be performed.

1st. The **Lateral Operation.**—The bladder may contain a little water; the bowels should be cleared previously by an enema.

A good firm table, 2½ feet high, is necessary for the operation. The patient should lie down and chloroform be administered. The sound or a staff should then be introduced and made to touch the stone, if possible, so that there may be no mistake. The patient should then be placed on his back, with his shoulders raised by a pillow. Then the perineum should be thoroughly exposed; the thighs must be raised and separated; knees bent, and each foot must be grasped with the hand of the same side. The hand and foot must then be firmly bound together with a bandage. The buttocks should be brought to the edge of the table and the perineum shaved. An assistant on each side holds the thighs asunder; the surgeon places the fingers of the left hand on the right buttock, and with the thumb fixes and steadies the integuments of the perineum, taking care not to draw them up. He then makes a free incision of the skin and subjacent tissues, entering the knife just on the left side of the raphé, about one and three-quarter inches in front of the anus, and cutting downward to midway between the anus and the tuberosity of the ischium The blade of the knife should next be run along the surface of the exposed fat and cellular tissue, and then the forefinger of the left hand thrust into the wound, about its middle, and directed upward and forward between the left erector and accelerator muscles; the finger then feels the groove of the staff in the membranous part of the urethra.

The left forefinger nail is now to be well fixed in the groove of the staff, the knife is slipped in over it, with its flat surface obliquely placed; its points made to slide along the groove toward the bladder, dividing the membranous part of the urethra and the edge of the prostate. The knife being withdrawn, the left forefinger is gently insinuated along the staff. Next the assistant removes the staff and the surgeon introduces the forceps over the finger into the bladder.

FIG. 110.



Lateral Operation.

2d. The **bilateral operation** is performed by making a curved incision, with the convexity upward, from one side of the perineum to the other, carrying it between the anus and the bulb of the urethra, opening the membranous portion of the urethra, and then pushing the *bistouri caché* into the bladder, by which both sides of the prostate may be divided.

3d. The **recto-vesical operation** consists in cutting into the bladder from the rectum, in the middle line behind the prostate.

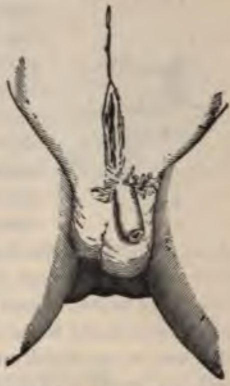
Suprapubic Cystotomy.—This operation is performed in cases of retention of urine, due to hypertrophy of the prostate gland, for the purpose of removing tumors, or stone in the bladder.

The day before the operation the bowels should be well opened, and just prior to commencing an enema of warm water should be administered; the hair should be shaven from the pubis, and the skin prepared in the usual manner.

A soft rubber catheter is next passed into the bladder, and the urine drawn off. A Peterson bag is oiled and inserted into the rectum, which is then distended with from ten to twelve ounces of warm water, the bladder receiving from eight to ten ounces of warm boracic acid solution; the catheter is then removed and a rubber band applied around the penis to keep the fluid from escaping.

An incision is now made three inches in length, beginning one half an inch below the upper edges of the pubis, and extending upward, keeping in the median line and going through the various structures until the transversalis fascia is divided, when some loose connective tissue and fat containing large veins will be reached; these must be separated with a pair of thumb forceps until the bladder is reached; this can be distinguished by fluctuation, color, and the arrangement of the muscular fibres. Now seize the bladder transversely in the upper portion of the wound, hold it steadily with the left hand, and open it with a scalpel, cutting toward the pubis. After the foreign body is removed, the band is taken from the penis, the rectal bag emptied and withdrawn, a small drainage tube is inserted in the lower angle of the wound, and the other portions of the opening closed with sutures. Any bleeding vessels must be secured and the case treated as any ordinary abdominal section.

FIG. 111.



Supra-pubic Lithotomy Incision, seven days after the Operation. Only the upper part of the wound was sutured.

HARE-LIP.

Hare-lip is a congenital fissure of one or both lips; generally perpendicular, but it may be more or less oblique.

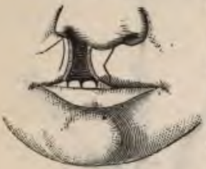
As a rule, the division is just below the septum of the nose, but it sometimes corresponds to one of the nostrils.

Hare-lip may be single or double; single when the fissure is only on one side, and double when there are two fissures with a small flap of skin between.

In the operation for the relief of hare-lip the principle is union by the first intention.

If the case is one of single hare-lip, detach freely the lip from the bones behind, then pare off the edges of the fissure by means of a small bistoury; care must be taken to cut off a sufficient quantity of the edge, as at the margin the parts are apt to be callous. The surgeon pierces the lip with a narrow knife at the top of the fissure, just under the nose, and carries the instrument downward, so as to shave off the edge of the fissure; the operation is then repeated on the other side, and the two strips are then detached at the upper angle. The parts are now brought together as nicely as possible, and retained in their position by means of the twisted suture. Three pins should be used for the purpose; the first is put at the edge of the red margin of the lip, and the two others at equal distances higher up. Then a long piece of thick silk should be twisted around the pins, and the sutures covered with collodion. The pins used should be galvanized, or made of silver; in the absence of these, needles may be employed, when the point should be carefully clipped off after the silk has been twisted around them. If the hare-lip is double, the operation should be conducted as in single hare-lip, but the closure of the second fissure should not be attempted for at least two weeks after the first operation.

FIG. 112.



Hare-lip.

AFFECTIONS OF THE NASAL PASSAGES.

FOREIGN BODIES IN THE NARES

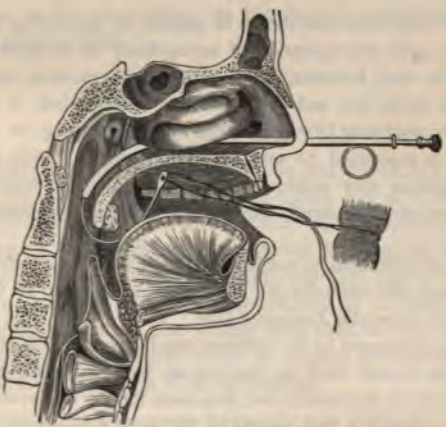
should be removed as soon as possible; their removal may be effected by a small spoon or canula. If they cannot be brought through the nostrils, they should be gently pushed back into the throat.

EPISTAXIS.

Hemorrhage from the nose may be produced by injury, by vascular excitement, plethora, or determination of blood into the head, by the suppression of some other discharge, by irritation of the mucous membrane, by passive draining of venous blood, and by a want of tone or contractility in the blood-vessels.

Treatment.—Ordinary cases of epistaxis can readily be controlled by simply closing the nostrils with the thumb and forefinger for the space of ten minutes, at the same time breathing through the mouth. If the patient be full-blooded and plethoric, and subject to headache and giddiness, a purgative should be administered and the diet regulated; if the bleeding continues, aromatic sulphuric acid should be given, and if the patient be anæmic, iron and quinine should be used. If it is a *passive hemorrhage*, depending on general cachexy, the patient should be kept quiet in a cool room ; he should lie with his shoulders raised; he should suck and swallow pieces of ice, and should apply ice or ice-cold water to the nose and forehead, and a bladder of the same to the nape of the neck. In persistent cases, plugging the nostrils is necessary. This is done by Bellocq's canula, which is a curved silver tube, in which lies a curved spring, having at the end an eye for the reception of a piece of string; this is drawn into the canula, the curved end of which is passed along the floor of the nostril. The spring is then protruded by pushing the handle, causing the spring and string to appear in the back of the mouth below the soft palate, where it can be secured with the finger and forceps. The end of the string in the pharynx is then brought through the mouth, and a piece of soft sponge is tied to it; then, by pulling the string back through the nose, the sponge is thrown into the posterior opening of the nostril, leaving one end of the string in the corner of the mouth. The anterior nares should then be plugged by a fold of lint passed on the end of the probe and tied in by the nasal end of the string.

FIG. 113.



Application of Bellocq's Canula.

FOREIGN BODIES IN AIR PASSAGES.

The foreign body may be impacted in the ventricles of the larynx, or in the trachea, in which case it will probably produce violent spasmodic cough and *difficulty of breathing*, together with fixed pain in one particular spot, a croupy sound during respiration, readily detected by the stethoscope, loss of voice and probably acute inflammation.

It may be loose in the trachea, especially if it be a pebble, grain of corn, or coffee, or other smooth substance. In such case the violent coughing and sense of suffocation produced by the first introduction of the article generally subside for a time, but every now and then there are violent fits of coughing and spasmodic difficulty of breathing, during which the substance may be heard by means of the stethoscope.

It may have passed into one of the bronchi, where it is frequently detected by causing a whistling or murmuring sound, and it may be dislodged and driven upward when the patient coughs. The right bronchus is that into which it generally falls.

Treatment.—Very little time should be wasted in attempting to get rid of the foreign body, until the operation of laryngotomy or tracheotomy is performed; it may be well, however, if the substance is movable and round, to place the patient on the bed and administer an opiate, when it may become coated with mucus, and may be expectorated during coughing or vomiting, or when the patient is narcotized he may be quickly turned upside down, when the foreign substance may suddenly be ejected; these devices failing, if the substance is arrested sufficiently high up, the surgeon must resort to laryngotomy.

Laryngotomy, is performed by cutting longitudinally through the skin, then horizontally through the *crico-thyroid* membrane, which may be felt as a soft depression an inch below the *Pomum Adami.*

Tracheotomy is performed by the surgeon standing on the left of the patient, whose head being thrown back, an incision an inch and a half or two inches long is made exactly in the middle line, from near the top of the sternum to the cricoid cartilage. The skin and superficial fascia are cut through; the sterno-thyroid muscles separated and a few fibres divided with the point of the knife; the loose cellular tissue and veins are cleared from the front of the trachea with the forceps, the thyroid gland is pushed up, a pair of slender hook forceps fixed in the trachea, so as to slightly draw it up; while the trachea is stretched, the surgeon passes his knife at the bottom of the wound and carries it upward, so as to divide two or three rings of the trachea.

Various other methods of performing tracheotomy have been devised, which the student can see by consulting larger works on Surgery; together with descriptions of tracheotomy tubes that are in use.

Intubation of the Larynx.—A suitable tube is selected, threaded with a long loop of silk, and fitted on a guide. This is screwed on to the introducer and a gag placed in the mouth on the left side.

The operator hooks the loop attached to the tube round the little finger of his left hand, and passes the index finger over the tongue on to the epiglottis, following it up closely with the end of the tube in his right. He then hooks the epiglottis forward, and slips the tube over it, when, if suddenly turned down and kept in the middle line, it must pass into the larynx, or over it on to the arytenoid cartilages, and so guides the canula. The moment it is in position the sliding tube should be shot forward, the guide drawn back, and the canula pushed on with the finger. The object of the loop of silk is to withdraw it, should it have missed the proper opening or passed into the pharynx.

The immediate effect is a violent fit of coughing; as soon as this ceases the loop may be cut, the silk drawn out, and the tube left.

Extraction, being more difficult, may require an anæsthetic. The forceps are introduced closed; the jaws separated from each other by touching a lever. The serrations are on the outer surface, so that there is no difficulty in holding the tube if it is once grasped.

AFFECTIONS OF THE EAR.

Accumulation of Wax, mixed with hair and cuticle, is a frequent cause of deafness. The patient complains of loud noises, and of a feeling of discomfort and defective hearing. An examination with the speculum will allow the wax to be seen. It will generally be removed by syringing, but should it not be brought away after two or three efforts, the best plan is to fill the meatus with glycerine, stop it with a bit of cotton, and let it remain for twenty-four hours, to soften the wax. The syringe may then be used again. A drop or two of olive oil, or of glycerine, should be inserted after syringing. The water used should be warm enough to be comfortable.

Small Follicular Abscesses frequently form within the meatus, especially in persons of weak constitutions. They are apt to recur and are very painful. Fomentations as hot as can be borne, the application of a leech, or some preparation of opium give relief. When the abscess is bound down by tough skin, a puncture will relieve the pain promptly. If the pain is very great, the patient should be given a dose of morphia.

Eczema of the Auricle is apt to produce thickening of the lining membrane of the meatus and membrana tympani.

The treatment consists in giving, during the *acute* stage, purges, and applying soothing fomentations; in the latter stage the black wash may be used as an injection, or dilute ointment of nitrate of mercury. Tonics and alteratives should be administered, such as quinine, iodide of potassium, cod-liver oil, etc.

PHIMOSIS AND PARAPHIMOSIS.

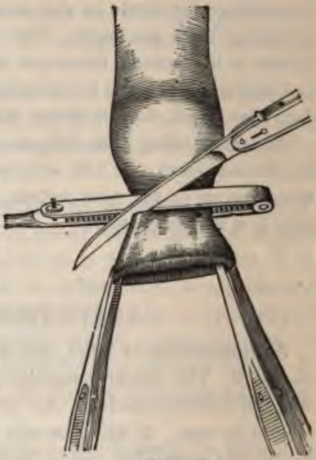
Phimosis is a constriction of the prepuce, which prevents the glans from being uncovered.

It may arise from inflammation of the cellular tissue and effusion of serous matter into it; it is frequently the result of chancre.

If congenital, this disability may be removed by gradual dilatation with sponge tents, or daily distention.

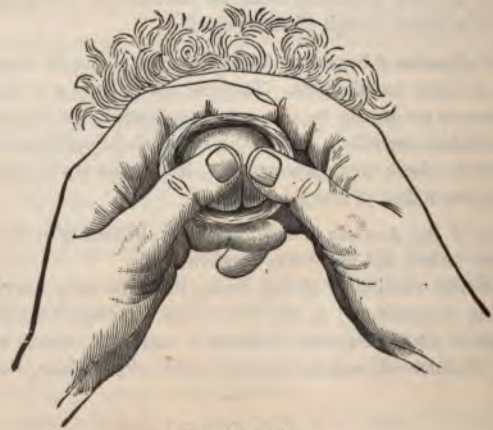
For radical cure, the operation for circumcision may be performed. If this operation is performed, the foreskin must be drawn out, held between the blades of the forceps, and then cut straight off, after which the mucous lining should be turned up so as to uncover the glans. Sutures should be passed through the margin of the incision, to draw together the edge of the skin and the mucous lining of the prepuce. For this purpose the interrupted suture should be used, made of silkworm-gut or cat-gut.

FIG. 114.



Phimosis.

FIG. 115.



Paraphimosis.

Paraphimosis is a constriction of the prepuce from inflammation, so that the skin, having been pulled back, cannot be again drawn over the glans penis.

Treatment.—The object is to reduce the strangulated part as quickly as possible. The penis being greatly distended with blood, take hold of the glans between the fingers, and endeavor to empty the vessels by gentle pressure. When this has been continued for a few moments, endeavor to reduce it by pushing the glans back, and at the same time drawing the skin of the penis forward. If the paraphimosis is not relieved by this treatment, it will be necessary to divide the stricture with a bistoury. Do this by separating the skin on each side; then insert a director under the stricture and divide it, which will allow the skin to be readily drawn over the penis. Then apply cooling lotions.

HYPOSPADIAS AND EPISPADIAS.

Hypospadias, a malformation, in which the canal of the urethra, instead of opening at the apex of the glans, terminates at the base, or beneath the penis. Hypospadias is ordinarily incurable.

Epispadias is the opposite of hypospadias; *i. e.*, it is a preternatural opening of the urethra at the upper part of the penis. The patient may be benefited by a plastic operation, depending on the case.

HYDROCELE.

Hydrocele is an accumulation of serum in the tunica vaginalis testis. It may be of the tunica vaginalis and of the spermatic cord.

The swelling of hydrocele of the tunica vaginalis first shows itself at the lower part of the scrotum, and gradually rises until it arrives at the abdominal ring; it is of a pyriform shape, largest two-thirds of the way downward, less at the bottom, and smallest at the ring. Usually it is attended with pain. Commonly there is no discoloration of the scrotum. The ordinary situation of the testicle is two-thirds of the way down the tumor at the posterior part, but it may sometimes be found in front or at the bottom.

The diagnostic signs are a sense of fluctuation, transparency, lightness, freedom from pain. In very old cases the tunica vaginalis becomes much thickened and the transparency may be absent.

Congenital Hydrocele.—When the tunica vaginalis preserves its communication with the abdomen, and then becomes filled with serum, forming a cylindrical tumor, extending to or through the abdominal ring, it is called congenital hydrocele. On being raised and compressed the fluid is slowly squeezed into the abdomen and slowly trickles down again afterward.

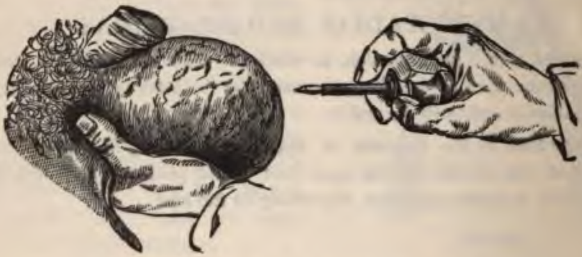
Treatment is either palliative or radical.

The evacuation of the serum constitutes the palliative treatment.

This is accomplished by a puncture with a grooved needle, or a small trocar and canula. Palliative treatment is sufficient for children, but rarely so in the case of adults.

Operation for Palliative Treatment.—The surgeon grasps the tumor behind and passes a trocar and canula into it, pointing the instrument slightly upward, to avoid injuring the testicle. He withdraws the trocar and allows the fluid to escape.

FIG. 116.



Palliative Operation for Hydrocele. (*Bryant.*)

The radical cure is effected by making an incision into the scrotum and opening the tunica vaginalis testis. If the hydrocele be of recent date and the sack thin it will be sufficient, after the fluid has been drained off, to wipe out the cavity with antiseptic cotton until thoroughly dry, and then apply pure carbolic acid to the part, packing the wound for twenty-four hours with iodoform bichloride gauze, which serves to drain the serum. When the packing is removed the sides of the cavity will fall together and adhere, when the hydrocele will be obliterated. The external wound should be dressed antiseptically. The patient will be well in about a week.

If the hydrocele should be one of long standing and the sack has become thickened, a free incision should be made over the long axis of the swelling, the tunica vaginalis testis dissected free, and the sack cut entirely away.

Care must be taken not to injure the cord. Any bleeding should be arrested, *the cavity washed* with a bichloride solution, a medium-sized drainage tube inserted, and the wound closed by means of silkworm-gut sutures. The tube is removed in twenty-four hours and the sutures on the sixth day.

The foregoing method has entirely superseded the operation by tapping followed by the injecting of various fluids. The palliative treatment is now only employed in the very old, in cases where a radical operation is not advisable, or where the patient wishes to get temporarily rid of the discomfort. The radical treatment is not advisable if the testis be diseased, or if the hydrocele be accompanied by irreducible hernia.

HÆMATOCELE.

Hæmatocele is an extravasation of blood into the tunica vaginalis.

Generally occurs as an immediate consequence of injury of the scrotum; sometimes it arises without any assignable cause.

There is swelling of the part, which comes on immediatly or soon after the receipt of the injury; it resembles hydrocele, as regards shape. At first the tumor is soft, and fluctuation may be detected, but when the blood coagulates it resembles in its character a solid growth.

Treatment.—In a recent case the first indications are to arrest the flow of blood and relieve pain. The horizontal posture, with testicles raised, is necessary; the iced bag and cold lotions must be applied; if the blood remains fluid for a long time, tapping may be performed. In chronic cases where there are signs of suppuration, a free incision should be made into the vaginal sac, and the cyst and the clot turned out. Then follows the usual treatment to promote healing by granulation.

VARICOCELE.

Varicocele is a varicose state of the veins of the spermatic cord. It is more common on the left side.

Treatment.—Keep bowels open; wash the scrotum frequently with cold water; support scrotum with suspensory bandage.

For radical cure it is recommended to pass a ligature subcutaneously, so as to divide veins only and not the skin. Operations on the veins are always attended with some risk. Many surgeons cut down on the veins, and ligate them with catgut; this method is known as the open operation.

This operation has largely superseded the subcutaneous method; it is more reliable; there is much less risk of infection; the patient recovers in a shorter time and endures far less pain.

Great care must be taken to prepare the individual; the day before the operation he must be put to bed, and remain there at least seven days. The pubis must be shaved, the parts must be thoroughly antisepticized, and the bowels must be completely evacuated. He must be ætherized. An assistant pinches up the skin over the enlarged veins; then the surgeon makes an incision three inches long, by transfixion; the veins are separated by means of a dry dissector; a stout catgut ligature is applied at the upper and lower angle of the wound, great care being taken not to include the vas deferens. The veins included between the ligatures are then cut away, the wound irrigated with bichloride solution, and the skin closed by interrupted silkworm-gut sutures and dressed in the usual manner.

In cases where the scrotum is pendulous and the veins varicose, the proper method of procedure is to leave the ligatures of sufficient length, so as to tie the uncut ends to each other, and at the same time bring the severed ends of the veins in apposition. This results in a shortening of the scrotum.

CARCINOMA OF THE TESTICLE—CASTRATION.

This is generally of the soft variety. Gland swells, becomes hard, heavy, and elastic; at this period it is scarcely painful or tender, and merely causes slight aching in the loins from its weight. After a time it enlarges rapidly and feels soft; the cord swells; the pain becomes severe and darting. Secondary tumors form in the iliac fossa, and emaciation, exhaustion, and death follow.

Castration.—The method of performing the operation is as follows: The scrotum being shaved, the operator grasps it behind, so as to stretch the skin, and makes an incision into the tunica vaginalis to examine the testis. If there is no doubt of the diagnosis, the cut is extended to the bottom of the scrotum. If the tumor is very large, two elliptical incisions may be made to remove a portion of the skin between them; then separate the cord from its attachments, an assistant holding it between his finger and thumb, or with a stout pair of forceps, to prevent it retracting when cut, a long, stout ligature being passed through its connective tissue, so that in the event of secondary hemorrhage the cord may at any moment be pulled out. Then pass the bistoury behind the cord and divide, and seizing the lower portion dissect out the testicle. All arteries requiring it are to be tied, and the wound is not to be closed until all bleeding has ceased, as there is frequently secondary hemorrhage.

HEMORRHOIDS.

Hemorrhoids are tumors situated near or in the anus, and are distentions of hemorrhoidal veins, with inflammatory swelling, congestion, and hypertrophy of the mucous or submucous tissue.

Piles are either external or internal; if situated within the rectum they are denominated internal; if they are seated on the verge of the anus they are called external.

If they are attended with discharge of blood they are called *open* or *bleeding piles;* when there is no discharge they are denominated *blind piles.*

The *symptoms* of external piles are pain when passing fæces, or tenesmus after discharge; at first there is a projection of a livid appearance, which in a few days becomes solid; the blood becomes coagulated in the hemorrhoidal veins. In a few days the pressure of the fæces brings down the pile, and it becomes external. When inflammation comes on the patient suffers greatly, and can only be tolerably comfortable in a recumbent position.

Treatment of External Piles.—If consulted early, while the pile is only a livid projection, an active purgative should be administered, avoiding such as have particular influence on the rectum, such as aloes. Leeches may be applied in addition. As a local application liquor plumbi acetatis is highly commended.

If the pile has continued until it has become solid, insert a lancet into it, and press out the clot; then apply a cooling lotion, administer a purgative, and the patient will be rid of the disease.

Whitehead's operation is performed when the sphincter is entirely surrounded by large hemorrhoids. The patient undergoes the usual preparation for a rectal operation. After being etherized, he is placed on his back in the position for lithotomy. An incision entirely surrounding the sphincter is made at the muco-cutaneous junction. The mucous membrane in which the hemorrhoid is situated is then dissected from the muscular coat, hæmostatic forceps being placed on bleeding vessels. The mucous coat is now brought down below the margin of the anus and the membrane above the hemorrhoid divided transversely and silk sutures are applied to the free margin of the skin below. The parts are irrigated and dressed with iodoform bichloride gauze. The bowels are kept confined for several days, and then moved by means of a saline cathartic.

Internal Piles are frequently accompanied by a high degree of fever, with a sense of weight and pain in the sacrum; pressing at stool causes the disease to show itself by prolapsus ani.

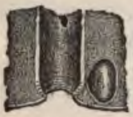
Treatment.—The irritation must be relieved by general and local treatment. Apply leeches and fomentations; if these measures do not cause relief, the pile must be removed by ligature.

FISTULA IN ANO.

This is a fistulous ulcer by the side of the rectum, through the fibres of the sphincter ani.

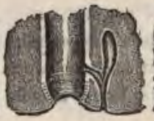
There are three kinds recognized in books: 1. The complete fistula, which has one external opening near the anus and another in the bowel above the sphincter. 2. The blind, or incomplete external fistula, which has no opening in the bowel. 3. The blind, or incomplete internal fistula, which opens into the bowel, but not externally

FIG. 117.



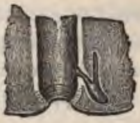
Ischio-Rectal Abscess.

FIG. 118.



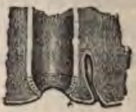
Complete Fistula.

FIG. 119.



Blind Internal Fistula.

FIG. 120.



Blind External Fistula.

Treatment consists in the division of the sphincter ani, so as to prevent the contraction of that muscle for a time. Before operating, the digestive organs must be put in good order, and a purgative must be administered, so that the bowels may not be disturbed for two or three days.

PROLAPSUS ANI.

This is an eversion of the lower portion of the rectum, and its protrusion through the anus. The affection is most common in infancy and old age. It may come from straining or from natural laxity.

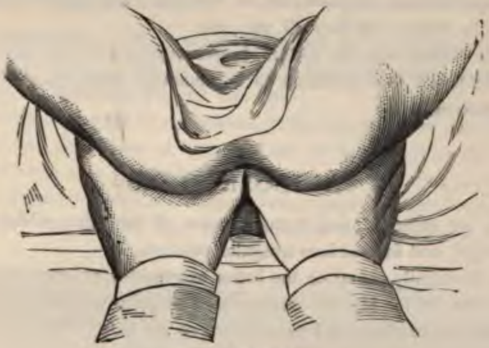
Treatment.—The parts should be carefully washed, and then replaced by gentle pressure with the fingers. If there is any difficulty, the forefinger, well oiled, should be pushed into the anus, when it will carry the protruded part with it, after which a thick compress, saturated with some astringent lotion, should be bound to the part by means of a T-bandage. The bowel is to be kept in its place by means of quietude and the recumbent posture, and, if necessary, tonics should be resorted to. Lotions of a solution of alum, sulphate of zinc, decoction of galls, and astringent injections are to be employed, if necessary. Should these means fail the patient should be etherized and the actual cautery should be resorted to; the affected parts should be seared on radiating lines. After the operation great care should be observed not to allow constipation to occur; for at least a year the alvine evacuations should take place in the recumbent posture. In most cases this treatment, with the Faradic current, will effect a cure.

FISSURE OF THE ANUS.

This is a small chap, crack, or ulcer, which gives intense pain during defecation, frequently continuing for some time after the evacuation. It may be the remains of an external pile, and is generally situated behind it, and leads to the fissure.

Purgatives frequently give relief, and lotions of sulphate of zinc, of tannin, nitrate of silver, or sulphate of copper are often beneficial: an ointment of galls with lead may be tried. Should these remedies not answer, *forcible dilatation* may be resorted to, so as to temporarily paralyze the sphincter muscle. To accomplish this the two thumbs, well oiled, must be introduced into the rectum, and then, by firmly grasping the nates with the fingers, the sphincter muscle is dilated by drawing the thumbs apart.

FIG. 121.



Fissure of the Anus.

Should this means fail, an incision into the part should be made, through the fissure or ulcer, with a straight, narrow, blunt-ended bistoury, so as to divide the mucous membrane, and in severe cases to divide the sphincter. A small piece of lint should be laid in the wound, so that it may heal by granulation.

CARCINOMA OF THE RECTUM.

may commence as a distinct tumor, or as an infiltration into the walls of the bowel, causing stricture. The earliest symptoms are uneasiness in the rectum, aching pain in the back, hips, and thighs, and irritation of the bladder. As the disease advances, the bowel becomes more or less obstructed; there is frequent discharge of a fetid muco-purulent matter, streaked with blood, and obstinate constipation attended with swelling of the abdomen, and sometimes with the symptoms of acute obstruction. There may be profuse and exhausting diarrhœa; peritonitis, or perforation of the distended bowels, with exhaustion, terminate the patient's suffering, in death.

Treatment.—Keep up the action of the bowels by enemata of warm water and very mild laxatives; allay irritation by occasional leeching, by belladonna and opiate applications, suppositories, or enemata. The patient's strength is to be sustained by tonics, cod-liver oil, etc., etc.

If the case is early seen the rectum should be resected; but if the disease has advanced, but is still in a condition to be removed, resort should be had to the Croskey operation.

VARICOSE VEINS.

Varix is an enlarged and tortuous state of the veins, which are usually thickened, rigid and formed into irregular pouches.

It is most frequently seated on the lower extremities, scrotum and rectum.

Varicose veins of the leg are accompanied by pain, weight, fatigue on taking exercise; they cause ulcers and excoriations of the skin; they sometimes burst, causing profuse hemorrhage, and occasionally blood clots in the veins, which may terminate in an abscess.

Treatment.—The *palliative* treatment consists in applying strips of leather over the part, a common roller, a Martin's roller, or an elastic stocking, which should be applied in the morning, before the patient rises. Galvanism or faradization has been recommended.

For the *radical* cure many methods have been devised; Sir B. Brodie recommended division of the vein by *subcutaneous* section; Watson, of New York, advocates *excision* of a portion of the affected vein; again, potassa fusa and quicklime, to cause slight inflammation, has been suggested. Pressure and the twisted suture both have their advocates.

CLUB FOOT.

This is a deformity of the foot, produced by rigidity and contraction of various muscles of the leg.

Talipes Equinus is where the heel merely is raised, so that the patient walks on the ball of his foot.

Talipes Varus.—The heel is raised, the inner edge of the foot is drawn upward, and the anterior two-thirds twisted upward, so that the patient walks on the outer edge, and in extreme cases on the dorsum of the foot and outer ankle.

Talipes Valgus.—The outer edge of the foot is raised, the longitudinal or inner arch flattened by the sinking of the head of the astragalus, and the patient walks on the inner ankle.

Talipes Calcaneus.—The toes are raised and the heel is depressed, so that the patient walks entirely upon it. There are also compound varieties, which need not be enumerated in a work of this kind.

These deformities may all be congenital, or they may appear after birth.

Contraction and shortening of the muscles are the cause of club foot. In non-congenital cases they may be brought on by spasms affecting many muscles, which may be dependent on a rheumatic fever, or produced by irritation directly from the spinal cord, or they may be sequelæ of bruises, injuries, or diseased joints.

Treatment.—In recent cases remove all irritating causes, soothe spasms, stimulate palsied muscles. If the case comes under the surgeon's notice before the contracted muscles become fixed, use constitutional remedies, fomentations, etc. In slight cases light splints of gutta-percha or wood, with bandages, may be of service.

In severe cases it is better to resort to Stromeyer's operation of *subcutaneous tenotomy*. By this operation the mechanical shortening of the muscle is obviated; the tendon being divided, its separated extremities heal by a new connective tissue, which renders it longer, and may be readily stretched while recent.

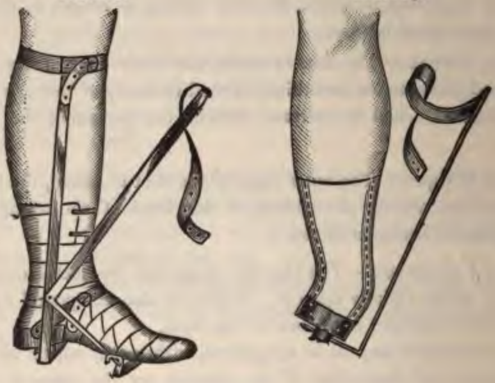
To perform this operation, the tendon is put on the stretch, and a narrow, sharp-pointed tenotomy knife is thrust through the skin on one side of it, then its edge is turned against the tendon and made to divide it as it is being stretched. Some surgeons prefer to pass the knife under the tendon, and then cut toward the skin, and others pass it between the tendon and the skin and cut toward the deeper parts.

In talipes equinus the tendo-Achillis is cut.

In talipes varus the tendo-Achillis, tibialis posticus, anticus, and flexor longus digitorum are divided.

In valgus the peronei and the extensor longus digitorum are severed.

FIG. 122. FIG. 123.



Dr. Allis's Club-foot Apparatus.

In some cases it may be necessary to cut a portion of the plantar fascia, or the muscles of the sole of the foot.

Dr. Oscar H. Allis has devised a "club foot apparatus," which can be readily understood by reference to the accompanying figures.

INGROWING TOE NAIL.

This affection is most frequent on the great toe; the incurvation usually exists on both sides, though more frequently on the inner side. It is generally a source of great suffering, on account of the pressure exerted on the soft part at the side of the toe, which swells, ulcerates, and discharges a foul, fetid fluid, and is covered with tender granulations.

It may arise from an abnormal formation of the nail, but it is frequently produced by the use of tight, narrow shoes.

If the disability is slight the patient may be relieved by the persistent use of scraped lint being inserted under the nail, a small roll of linen laid between the nail and the overlapping skin, and then applying a strip of adhesive plaster so as to keep the parts asunder. In severer cases the most reliable method is to excise the edge of the nail. With a strong scalpel the nail is divided its whole length, on a line with the incurvated edge, which is then detached, root and all being embraced in the operation. Warm-water dressing or opiated water is then applied and the part is kept at rest.

CARBUNCLE, OR ANTHRAX,

is a hard and circumscribed inflammatory spot of the true skin; varying in size, usually forming on the cheek, neck, or back; infiltrated with unhealthy lymph, and is a dull red swelling, very tender to the touch and accompanied by a heavy, aching pain.

Carbuncle is generally preceded by pain, and is from the first a swelling of considerable hardness; the surface of the tumor then assumes a livid redness and a spongy feel; little ulcers now form on the skin, which give it a sieve-like appearance, so numerous are the orifices; from these a whitish discharge exudes. When the little openings are formed into one, the dead cellular membrane begins to escape.

Carbuncles are generally accompanied by great prostration, sickness, loathing of food, headache, and other symptoms of low febrile impression.

Treatment.—It is well to begin the treatment with a calomel purge; after thorough purgation the treatment should be tonic and sustaining; the most suitable articles are quinine, iron, nourishing broths, and brandy. To allay pain and procure sleep an opiate will be needed.

The best topical application is the warm-water dressing, with acetate of lead and opium. Penciling the surface with tincture of iodine, and in some cases applying a blister over the infected part, are highly recommended. S. D. Gross recommends, as a speedy and effectual method of relief, the introduction at four opposite points of a delicate tenotome; making a subcutaneous division of the wounded tissue in such a manner as to traverse the entire swelling; or, after making the necessary incisions, paint the inflamed area with tincture of iodine, wash the part with bichloride solution, then apply adhesive plaster, leaving an opening for free drainage. Compress with bichloride sponge, and place over this iodoform cotton.

When the disease has passed into gangrene, the remedy is a free incision, the knife being carried through the skin down to the healthy structures beneath. If the dead tissues are slow in coming away, their extrusion may be expedited with the scissors, the surface of the ulcer being well touched immediately afterward with dilute acid nitrate of mercury or solid nitrate of silver, to promote the formation of healthy granulations. Use, several times a day, injec*tions of solutions of* chlorinated sodium, carbolic acid, permanganate of potassium, or common salt. When the sore begins to present a healthy appearance dress the parts with opiate cerate, or elemi ointment, or poultices of ground flaxseed.

BOIL, OR FURUNCLE.

A **Boil** is a hard, bounded, deep red, raised, and very painful swelling, situated in the sebaceous follicles of the skin, occurring on all parts of the body, usually terminating in suppuration.

A slight pain first attacks some part of the skin, a little swelling appears, which becomes elevated, hard, and of a deep red color, when the pain increases. The swelling becomes white at the top, it breaks, some pus mixed with blood is discharged, and then the destroyed cellular tissue, called the *core*, is discharged, when the surrounding hardness subsides.

Treatment.—The usual treatment is to poultice the part and make a free incision to let out the contents. For indolent boils a good application consists of glycerine and extract of opium, each a drachm, resin cerate, an ounce; it relieves the pain and irritation. Painting the part with tincture of iodine, or solution of nitrate of silver, are both recommended. Should the patient's condition require them, tonics should be employed, and when there is a tendency to recurrence, Fowler's solution, in doses of two or three drops, thrice daily, will be found efficacious.

According to Dr. Ringer, the sulphides possess the power of checking the formation of pus. Calcium sulphide, given in doses of a tenth of a grain hourly, is recommended where there is a succession of boils.

HOUSEMAID'S KNEE

is an inflammation of the bursa of the knee, between the patella and skin, which is common to housemaids, from kneeling. It is usually chronic, but may be acute. It causes great pain and swelling; it differs from inflammation of the synovial membrane by the swelling being most superficial, and in being in front of the patella, which is obscured by it; in inflammation of the synovial membrane of the knee, the patella is thrown forward, and the swelling is most prominent at the sides.

Treatment.—Rest, leeches, fomentations, and purgatives; if these do not bring relief, an incision should be made into the swelling. After evacuating the contents of the sac, a small quantity of equal parts of tincture of iodine and alcohol should be injected into it. Dr. Levis recommends injections of carbolic acid.

WHITLOW.

Paronychia, or Whitlow, is an abscess of the thumb or fingers.

The superficial whitlow consists of inflammation of the surface of the skin of the last phalanx, with burning pain or effusion of a serous or bloody fluid; it is generally seated immediately around and beneath the nail; it is attended with great pain and throbbing, and suppuration at the root of the nail, which may come off.

The deep-seated variety, or *tendinous whitlow*, as it is called, is attended with severe, throbbing pain, exquisite tenderness, light, but tense and resisting swelling, and very great constitutional disturbance. It may lead to suppuration, the matter extending itself along muscles and tendons from the fingers to the palm, and even to the forearm, causing sloughing of the tendons, with severe irritative fever, sometimes placing life in danger and frequently leaving the limb stiff and useless.

If purgatives and fomentations do not speedily bring relief, the finger must be freely laid open. The knife, used early, should be carried deep enough to feel the resistance of the bone or tendon; the sheath of the latter should be thoroughly laid bare. If the matter has extended to the hand, an opening should be made until complete drainage is established.

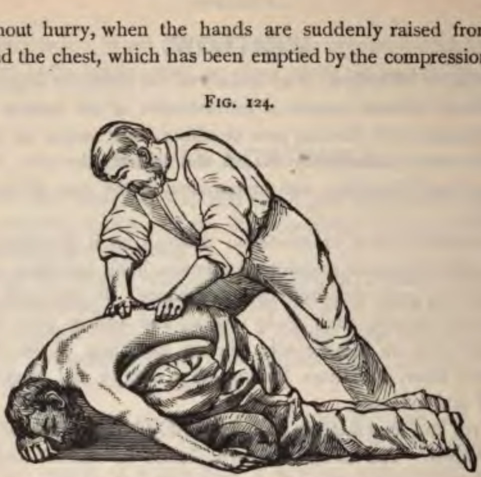
DROWNING.

Treatment of Drowning.—Let the head hang for *ten seconds*, so that any water may run out of the mouth; then lay down the body with the head raised; put the fingers in the mouth and draw the tongue well forward; wipe out the mouth and throat; strip off the wet clothes; wipe all parts of the body perfectly dry with warm cloths. If breathing has not quite ceased, rouse the circulation and respiration by friction of the entire surface, occasionally dashing cold water on the face, neck, and chest, and [illegible]en wiping quite dry with a warm towel; tickle the nose and fauces, to excite sneezing, coughing, or vomiting. If breathing should not be thoroughly restored by these means artificial respiration should be resorted to. There are several methods recommended.

1. **Abdominal and Thoracic Pressure.**—The operator kneels by the patient and places his hands near together, with the fingers pointing toward the head, the two thumbs approaching a little beneath the lowest point of the sternum, and the balls of the thumbs lying in the epigastrium, about three inches apart; the lower and thick part of the hand is firmly pressed downward, and as this part of the hand descends the fingers exert firm pressure on the lower part of the thorax. The pressure is continued until one, two, three be

counted without hurry, when the hands are suddenly raised from the lower part first; and the chest, which has been emptied by the compression, is allowed to refill with air by its own elasticity. The process is repeated as often as necessary.

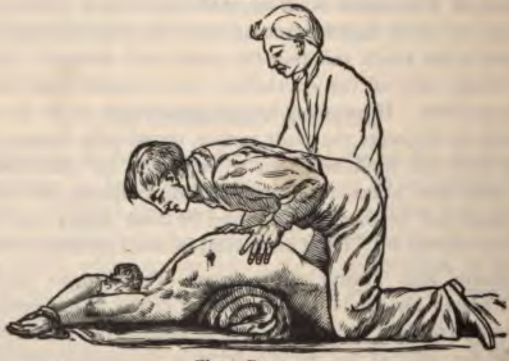
FIG. 124.



Abdominal and Thoracic Pressure.

2. **Chest Pressure.**—Professor Howard's plan: The patient is laid on his back, with a roll of clothing beneath the loins, so as to make the short ribs *bulge prominently* forward, and raise them a little higher than the level of the

FIG. 125.



Chest Pressure.

mouth. The arms are then stretched forcibly back over the head, crossed, and held in this position by an assistant, who also holds the tip of the tongue over one corner of the mouth, grasping it with a dry handkerchief. The operator then kneels astride the patient's hips, and, with his hands resting on the stomach of the patient, spreads out his fingers so as to grasp the waist about the short ribs. He next throws all his weight steadily forward upon his hands, while at the same time he squeezes the ribs deeply, "as if he wished to force everything in the chest upward out of the mouth." This pressure is continued while *one*, *two*, *three* can be slowly counted, when it is suddenly removed with a final push, which springs the operator back to his first kneeling position. After an interval, during which *one*, *two*, *three* can be slowly counted, the pressure is repeated and the process continued as long as necessary.

FARADIZATION.

A valuable aid to artificial respiration is faradization. A needle connected with the free end of one of the conductors is placed under the skin in the neighborhood of the right phrenic nerve; or, if preferred, over the *pomum Adami;* the other conductor, with a moist sponge attached, is applied on the right side of the chest at the level of the sixth intercostal nerve, or about an inch below the lower end of the sternum. The current must be strong enough to cause contraction of the muscles of the ball of the thumb, and the skin thoroughly moistened with salt water.

BANDAGING.

Bandages are made of unglazed muslin, flannel, linen, calico, cloth, or india-rubber, in lengths of from two to ten yards, and in widths to suit the purposes for which they are needed; ordinarily, unbleached muslin is preferred.

A bandage should have a width of three-quarters of an inch for the fingers or toes; two to two and a half inches for the upper limbs; three inches for the lower limbs, and six inches for the body.

When a bandage is tightly and evenly rolled, it is termed a *roller*.

Bandages are designated single-headed or double-headed rollers, according as they are rolled into one or two parts. The ordinary roller in general use is the single-headed.

When applying a bandage, the dresser should grasp the roller in one hand, holding the loose end in the other; apply it to the limb so that the *outer surface* may be against the skin, and so that the bandage will lie close to the limb.

The *spiral* is most frequently employed in the treatment of affections of the extremities, or trunk.

In applying the *spiral*, each turn must cover at least one-third of the one below. Owing to the enlargement of the limbs at the outer part, it is impossible to apply the bandage without making "turns" in it; such a turn is called a "reverse," which is the folding of the bandage upon itself, so that it will fit snugly to the limb. To divide this properly, the student should be careful to remember that a turn should never be made over a prominence of a bone, and, if possible, it should be made on the outside of the limb; also, that when making the reverse the bandage should be held quite loosely, so that with a single movement of the wrist the turn can be made, carrying the hand from supination to pronation.

FIG. 126.

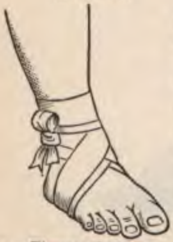


Figure-of-eight.

In making the turn the hand should be held slightly above the level of the limb, and great care must be taken not to unroll more bandage than is actually required.

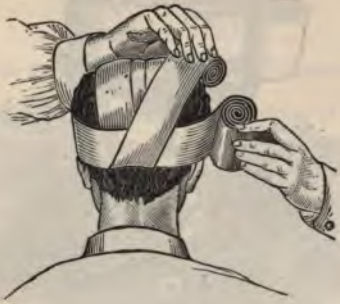
Figures-of-eight are made by passing the roller alternately upward and downward as it enwraps the limb *(Fig. 126). They are used when the enlargement is too great and irregular for reverses to lie evenly,* as over the ankle and elbow joints.

THE HEAD.

RECURRENT BANDAGE OF THE HEAD. DOUBLE ROLLER.

The roller for the head should be two inches wide. The best bandage for the head is the capeline (Fig. 127); the double-headed roller is used for this purpose. The surgeon, standing in front or behind, takes one head of the roller and places the middle of the bandage on the occiput or the forehead. The two parts are then brought around and crossed on the forehead or below the occiput. One of the ends is then continued round, and the other, which is lying below it, is turned up and brought over the head, as in the recurrent bandage. It is now met by the other half of the bandage, which has been carried around the head, while the first half has gone over it, and the former, continued round, fixes the bandage so that it can again be brought over the head, when the manœuvre is repeated.

Fig. 127.



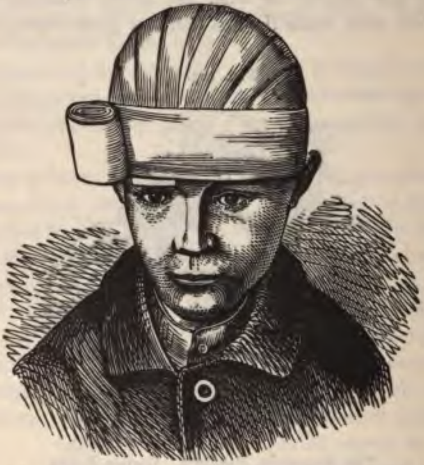
The Recurrent Bandage. Double Roller.

If it be necessary to apply pressure at the side of the head, as in the case of a wound of the temporal artery, a couple of simple turns around the forehead and occiput may be taken, and then the bandage made to ascend and descend alternately as it passes over the point where pressure is to be applied. (Fig. 131.)

RECURRENT BANDAGE OF THE HEAD. SINGLE ROLLER.

Place the extremity of the roller on the lower part of the forehead, then in order to secure the bandage carry it twice around the head from the forehead to the occiput. Reverse the bandage when it is brought back to the median line of the forehead and hold with the finger of the left hand the reversed turn; carry the roller over the top of the head along the sagittal suture to a point just below the occipital protuberance; it is now again reversed; the reverse being held by an assistant while the roller is being carried back to the forehead in an elliptical course, each turn covering in two-thirds of the preceding turn. Repeat these turns with successive reverses at the forehead and occiput, until one side of the head is completely covered; when this is accomplished a circular turn is made from the forehead to the occiput, so as to hold the reverses in place.

FIG. 128.



The Recurrent Bandage. Single Roller. (*Heath.*)

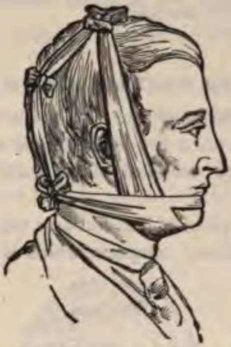
The opposite side of the head is now covered in elliptical reverse turns, made in the manner here described; then carry the roller around the head from the forehead to the occiput by two or three circular turns, so as to firmly fix those previously made. The necessary pins should be applied where the reversed turns concentrate.

The roller should be eight yards long and two inches wide.

FOUR-TAILED BANDAGE.

The four-tailed bandage answers a very useful purpose when required to *retain dressings.* It consists of a piece of muslin about three yards in length, split up to within a few inches of the centre, so as to form four strips; the two anterior are carried back and tied under the occiput, while the posterior are fastened under the chin. The position of the tail is reversed according as the middle portion of the bandage rests on the forehead, chin, or occiput.

Fig. 129.

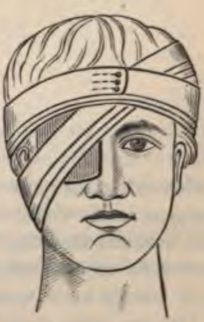


The Four-tailed Bandage Applied. (*Bryant.*)

BANDAGE FOR ONE EYE.

Make two or more circular turns around the forehead and occiput, passing from right to left, if for the left eye, and from left to right, if for the right eye. After making the second turn, on reaching the nape, carry the roller under the ear of the affected side, and then obliquely up over the jaw and the affected eye; inclining well to the internal canthus, so as to cover the root of the nose, but not the sound eye. Pass across to the temple of the sound side; descend to the nape, and repeat two or three oblique turns, finishing by circular turns around the forehead. (Fig. 130.)

Fig. 130.



Bandage for One Eye.

FOR BOTH EYES.

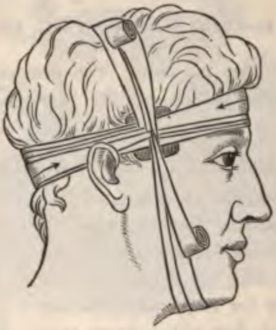
Make two or three circular turns of the head, turning from left to right, or *vice versa;* on reaching the nape, pass under the ear of either side up over the eye, root of nose, and parietal protuberance of the opposite side, and return to the neck. Make two or three of these turns, and then pass from the parietal protuberance around the forehead, across the root of the nose, the eyes and cheek of the opposite side, making an X with the first turns, and repeat in oblique turns, terminating in circular ones.

KNOTTED BANDAGE OF THE HEAD.

To secure pressure on the superficial temporal artery. The articles required in the use of this bandage are a two-headed roller about eight yards in length; some lint; a piece of cork one-third of an inch thick; needle, thread and pins.

The cork is folded in a piece of lint, and over this are placed several folds of lint so as to make a graduated compress, which is laid on the wound with the small end downward.

FIG. 131.



Knotted Bandage.

One end of the roller is taken in each hand, and the middle is laid over the compress on the wound; the ends are then carried around the head, above the eyebrows, and the other backward below the occipital protuberance, till they meet at the opposite temple, where they are brought from one hand to the other to be brought to the wounded temple.

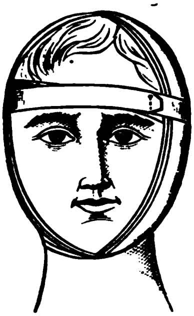
They are again crossed tightly, one end being carried under the chin, and by the left or right side to the vertex, there meeting the other end, which has passed over the head in the opposite direction. The hands again change ends, and the bandaging continues till each end reaches the injured temple. Here *they are again crossed* or knotted, when the ends are passed horizontally around the head. The ends are now pinned and cut off. Each knot must overlie its predecessor. (Fig. 131.)

THE CROSSED ANGLE OF THE JAW.

Required, roller five yards long and two inches wide, together with a thick compress.

Begin with placing the initial portion of the bandage on the forehead and carry it twice around the cranium, turning from right to left, and backward if the disease or injury is on the left side, and *vice versa*. From the nape of the neck carry the roller close under and behind the ear of the sound side, under the jaw to the angle of the jaw on the injured side, and place the compress behind and on this angle. Now carry the roller over the compress, up over the side of the face, between the eye and the left ear; obliquely over the vertex and down behind the ear opposite the injured side. Make three or four oblique turns, and terminate by circular turns around the forehead.

FIG. 132.



Crossed Angle of the Jaw.

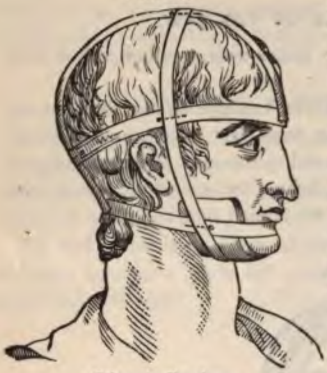
This bandage is used in treatment of fractures of the neck and angle of the jaw; in tumors of the parotid region, and in retaining dressings to this part.

GIBSON'S BANDAGE FOR FRACTURE OF THE JAW.

For this bandage is required a roller five yards long and two inches wide, and a compress or splint, if necessary.

Close the mouth firmly, mould the jaw into proper shape, if necessary, and make the lower teeth press upon the upper; place a compress under the fractured portion, which must be held in place by an assistant; then apply the end of the roller to the top of the head, pass it down the side of the face, under the jaw and over the compress, up the other side of the face to the place of starting; carry the roller around three times; after the third turn make a reverse on the temple, carry it around so as to be perpendicular to the bandage on the face, and surround the forehead and occiput by circulars of the cranium. On the third turn pass from the occiput over the back of the neck and under the ear, to make three circulars of the chin and neck; from the neck pass obliquely upward to go circularly around the forehead. Place pins at each crossing. A strip should be carried from the forehead over the vertex and fastened to the turns on the neck.

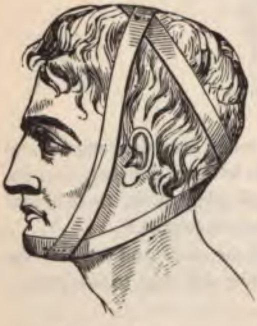
FIG. 133.



Gibson's Bandage.

BARTON'S BANDAGE.

FIG. 134.



Barton's Bandage.

The roller should be five yards long and two inches wide. The initial extremity should be placed just below the prominence on the os occipitus; then continue the roller obliquely over the centre of the parietal bone; across the junction of the coronal and sagittal sutures, under the chin, carrying the bandage over the same direction on the opposite side until you arrive at the back of the head; then pass obliquely around and parallel to the base of the lower jaw, over the chin, continuing the same course on the other side, till it ends where you commenced. Pass the bandage around in this manner three times, and place a pin at the vertex.

BANDAGES OF THE TRUNK.

FIGURE-OF-8 BANDAGE OF NECK AND AXILLA

is used to retain dressings at the base of the neck, before, behind, or above the shoulder. A roller five yards long and two inches wide is used. The initial extremity is placed on the side of the neck, and retained by one or two circulars loosely cast around the neck. If applied to the right shoulder, direct the roller as it comes from the left side of the neck over and behind the right shoulder, so as to confine the required dressing in the axilla or on the shoulder; then bring it up in front and over the shoulder and around the neck to the left side; follow this course, and cover the preceding turn by one-third of the bandage, so as to make a figure-of-8, one turn of which shall embrace the neck, and the other the axilla.

FIG. 135.

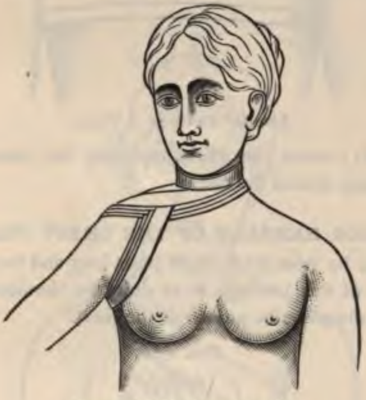


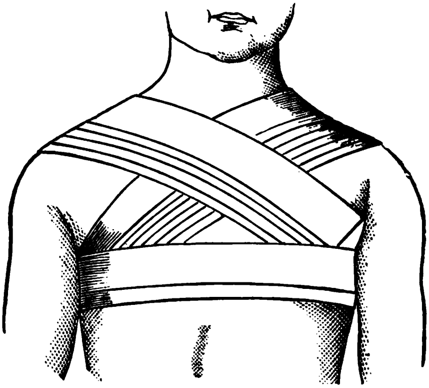
Figure-of-8 Neck and Axilla.

ANTERIOR BANDAGE OF THE CHEST (Figure-of-8).

The roller should be eight yards long and two and a half inches wide. The object of this bandage is to draw the shoulder forward, and to retain dressings on the surface of the chest.

Commence at the axilla of either side; take two circular turns around the chest to the place of beginning; from thence carry the bandage obliquely upward across the chest to the shoulder, over the shoulder backward and downward *to the axilla*; under the axilla obliquely upward across the chest to the opposite shoulder; over the shoulder backward and downward to the border of the axilla; under the axilla, repeating the turns three times, and finish by circular turns around the chest.

FIG. 136.

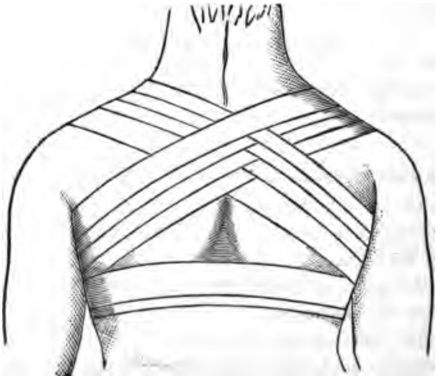


Anterior Bandage of Chest.

POSTERIOR BANDAGE OF THE CHEST (Figure-of-8).

The roller should be from six to eight yards long and two and a half inches wide. The object of this bandage is to draw the shoulders backward, or to retain dressings on the posterior surface of the chest.

FIG. 137.



Posterior Bandage of Chest.

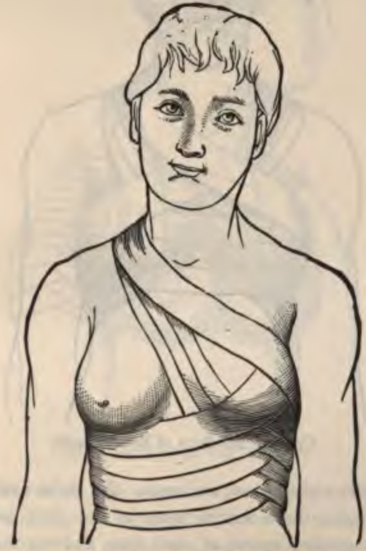
From the left shoulder pass obliquely over the back to the right axilla, the shoulders being forced backward; ascend in front and over the shoulder; pass over the back to the left axilla, over the compresses (if any), in front of this, and around to the back, over it in front, and over the back to the left axilla. Pass over this course until the roller is within three yards of being exhausted, then finish by circular turns around the chest.

CROSSED BANDAGE OF ONE BREAST.

This bandage is used to support the breast. The roller should be eight yards long and two and a half inches wide.

Commence at the axilla of the affected side; carry two circular turns under the breast, around the chest to the point of origin; thence obliquely upward under the affected breast; cross the front of the breast to the shoulder; over the shoulder, obliquely downward across the back to the point of origin; then take a circular turn under the breast, around the chest to the point of origin.

FIG. 138.



Crossed Bandage of One Breast.

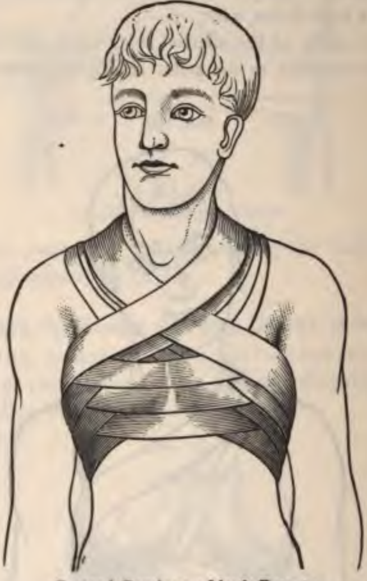
Continue to take these turns, alternating and advancing in the oblique and circular turns until the breast is fully supported.

CROSSED BANDAGE OF BOTH BREASTS.

This bandage is used to support both breasts. The roller should be from ten to twelve yards long and two and a half inches wide.

Place the initial extremity of the roller behind the right axilla, crossing the back; carry the bandage over the left shoulder, pass obliquely across the front of the chest, under the right breast, and under the right axilla to the point of departure. Make two or three oblique turns of the neck and axilla, covering in the breast by the gradual ascent of each turn, and on reaching the back of the right axilla in the third turn, pass transversely across the back to the left axilla; under this and across the chest in front of the left breast to the right side of the neck; then across the back to the left axilla. Repeat two obliques of the neck and left axilla, and on reaching the front of the left armpit pass *transversely under* both breasts to the right axilla, from thence to the point of

FIG. 139.



Crossed Bandage of both Breasts.

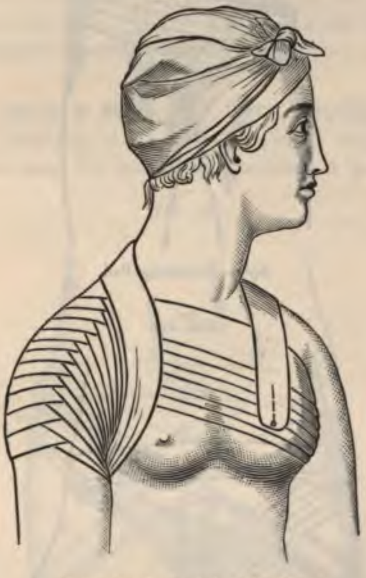
departure, care being taken that each revolution covers successively the breasts from below upward.

SPICA BANDAGE OF THE SHOULDER.

This bandage is used in dislocations of the humeral extremity of the clavicle, or to retain the head of the humerus in place after dislocation has been reduced. Length of roller eight yards; width two and a half inches.

Make three spiral reversed turns around the upper part of the arm of the injured side, passing from without inward and from before backward; pass from thence from behind the arm up over the lower extremity of the shoulder, then obliquely downward over the front of the chest to the axilla of the sound side; thence around the back obliquely upward over the shoulder, and down in front under the axilla of the injured side, taking care to use some cotton batting or a compress to protect the point of injury. From this point go behind and over the shoulder, pursuing the same course as before, each turn covering in one-third of the preceding turn until the bandage is sufficiently exhausted to be made to terminate by one or two circulars of the trunk.

FIG. 140.

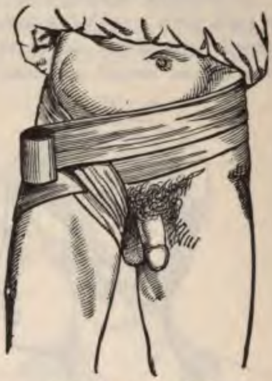


Spica Bandage of the Shoulder.

SPICA BANDAGE OF THE GROIN.

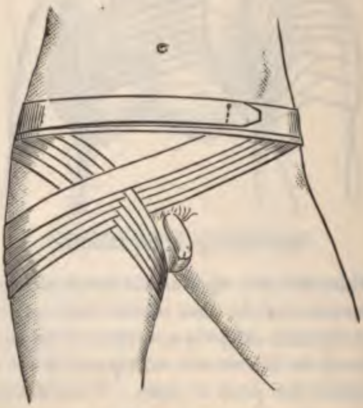
Requires a roller eight to ten yards long and three inches wide. This may be done in one of two ways. 1st Method: The bandage is to be carried along *the lower part of* the groin of the affected side, from within outward, over a

FIG. 141.



Spica Retaining Pad.

FIG. 142.



Single Spica of Groin.

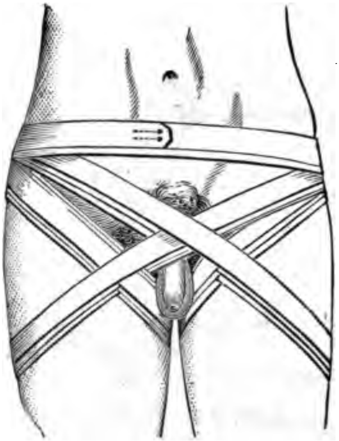
pad, if necessary; then pass around the pelvis, and back over the pubes, crossing the former fold of the groin, completing the figure-of-eight. A series of such turns, each slightly overlapping the other, must be repeated until the part is covered, and a sufficient amount of compression is produced.

2d Method: Place the initial extremity of the bandage above one of the iliac crests, make two horizontal circular turns around the pelvis, so as to fix the front of the bandage, turn from right to left, and from before backward, if for the right groin, and the reverse if for the left. Arriving in front of one of the groins descend to the inner side of the thigh, between it and the genital organs, and winding around the back part ascend on the outer side so as to cross the first turn; from thence to the iliac bone of the opposite side, across the back and around the pelvis to follow the same course.

DOUBLE SPICA FOR BOTH GROINS.

A roller twelve yards long and three inches wide is required. First, make two horizontal turns about the pelvis; upon arriving at the second turn, near the groin—the left, for instance—turn the roller so that it will pass obliquely downward along the outer side of the thigh, and ascend along its inside so as to cross the first descending turn; it is then conducted around the back of the pelvis as far as the right groin, and made to pass along the inner side of the

FIG. 143.



Double Spica, for both Groins.

right thigh; remounting on its outer side, and carried again around the pelvis in front, and to the left. The bandage pursues this course until a sufficient quantity of the bandage remains to terminate by two horizontal turns of the pelvis.

TO BANDAGE THE PERINEUM AND PUBES.

A roller six yards long and three inches wide is required for this bandage.

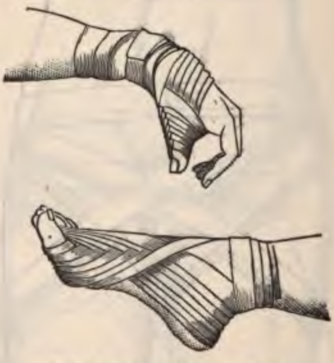
After a turn around the body, the bandage passes obliquely down across the left groin, then behind the left thigh, just below the fold of the nates, and obliquely upward, across the perineum, and through the right groin toward the right iliac spine. It then passes round the body behind, and from the left iliac spine obliquely downward, along the left groin, to cross the perineum, and go below the genital fold on the right thigh, and so around the body again.

BANDAGES OF EXTREMITIES.

SPIRAL, OF ONE FINGER.

Bandage four feet long and one inch wide required. Fix the initial extremity around the wrist by two or three circular turns; cross the back of the hand so as to descend either finger to its extremity, which is then bandaged downward to the root, by ordinary spiral reversals, and terminates by a few turns around the wrist.

FIG. 144.



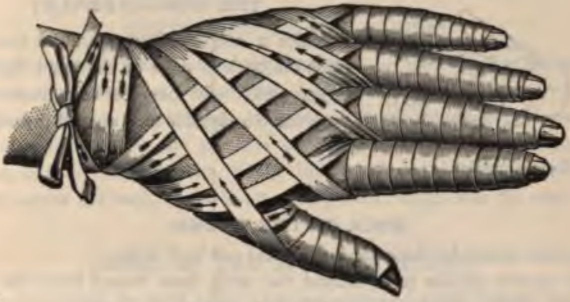
Spiral, of One Finger or Toe.

SPIRAL, OF ALL THE FINGERS.

This bandage should be eight yards long and one inch wide. Begin by one *or two circulars* around the wrist; pass obliquely over the back of the hand,

and descend by oblique turns to the end of the forefinger, then ascend, by reverse turns, to its base; then pass to the middle finger, ascend and descend, as in the case of the forefinger, continuing until all the fingers are covered in.

FIG. 145.



Spiral, of all the Fingers.

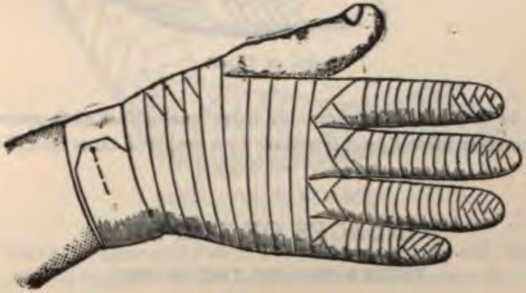
Then pass to the back of the hand, or front if preferred, and finish by circulars around the wrist.

THE GAUNTLET, OR SPIRAL FOR ALL THE FINGERS.

Roller should be eight yards long and one inch wide.

Commence with two circulars around the wrist; pass obliquely over the back of the hand; descend, by oblique turns, to the nail of the forefinger, then ascend by *reversed turns to the* base; descend, by oblique turns, to the nail of the

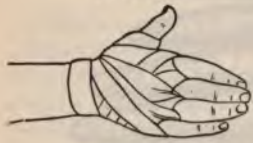
FIG. 146.



Gauntlet, for Fingers.

middle finger, ascend by spirals to the base, and continue this until all the fingers are covered. From the base of the little finger pass in front of the hand, finishing by circulars around the hand and wrist.

FIG. 147.



Demi-Gauntlet.

THE DEMI-GAUNTLET.

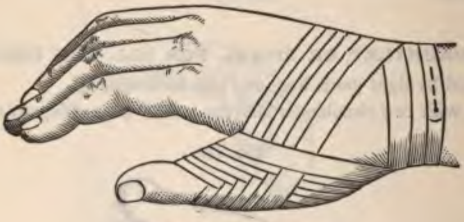
Make a couple of turns around the wrist; cross the back or palm of the hand by oblique turns, which will pass between each finger; then make a circular turn around the wrist.

SPICA OF THE THUMB.

The roller should be three yards long and one inch wide.

Begin by two circular turns around the wrist, from thence cross the base of the thumb to the phalangeal articulation; around the thumb, thence to the wrist, and so continue, taking care to cover one-half of each preceding turn until the thumb is covered, and terminate by a couple of turns around the wrist.

FIG. 148.



Spica, of Thumb.

BANDAGES OF THE ARM.

FIGURE-OF-8 OF THE WRIST.

Roller should be two yards long by two inches wide. Take two circular turns around the wrist, commencing on either the dorsal or palmar surface; *when reaching the* latter side, turn obliquely across to the space between the *thumb and forefinger*—for instance, of the right hand; from thence obliquely over the palm to a corresponding point on the metacarpal bone of the little finger; from thence obliquely across the back of the hand to the wrist joint; now make a semi-horizontal turn around the wrist to the ulnar side. Repeat same course over again, terminating with a turn around the wrist.

FIGURE-OF-8 OF THE ELBOW.

The roller should be two yards long, and two and a half inches wide.

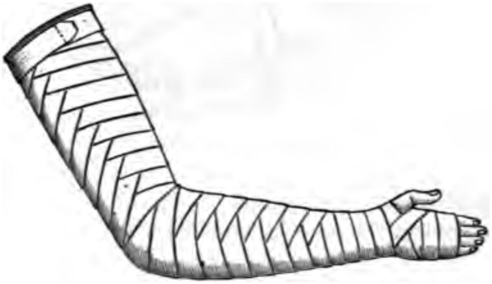
Begin at the external and upper part of the forearm; pass obliquely over the bend of the arm to the internal tuberosity of the humerus, and carry it on around the olecranon to the external tuberosity; from thence obliquely over the front, crossing the first turn, to the inner and upper part of the forearm, and then across the back, to the point of departure, to go over the same course.

SPIRAL OF THE UPPER EXTREMITY.

The roller should be eight yards long, and two and a half inches wide.

Begin with two circular turns around the wrist; from thence pass obliquely over the back and palm of the hand to the fingers; ascend by spiral turns until the phalangeal metacarpal joint of the thumb is reached; cover this and the wrist joint by a figure-of-8; ascend the limb, by simple and reverse turns, until the elbow is reached. If the arm is to be flexed, cover the elbow with figure-of-8; if not, employ spiral turns without reversing, and continue the spiral and reverse turns to the shoulder, using such compresses, etc., as may be necessary.

FIG. 149.



Spiral, of Upper Extremity.

BANDAGES OF THE LOWER EXTREMITY.

FIGURE-OF-8 OF THE ANKLE.

The roller should be from two to three yards long and two and a half inches wide.

Take two turns around the leg above the malleoli, then go obliquely downward in front of the ankle to the side of the foot, from thence under the sole of the foot to the opposite side, pass obliquely upward in front of the ankle to the beginning, ending with as many turns around the ankle as may be necessary.

FIG. 150.

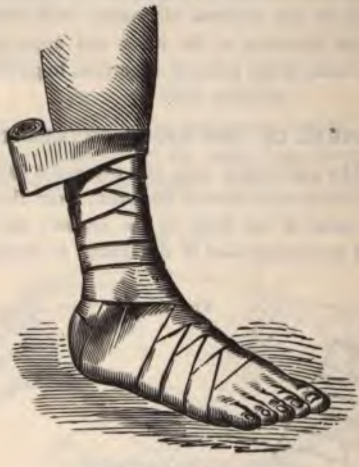


Figure-of-8 of Ankle.

FIGURE-OF-8 BANDAGE OF THE KNEE.

The roller should be two yards long and two and a half inches wide.

Commence at the upper part of the leg, below the knee, making one or two circular turns; pass obliquely upward across either the patella in front or over the back of the knee to the lower part of the thigh, then pass around the thigh and come from the opposite side of the thigh obliquely downward across the *front or back of* the knee to the side of the leg, repeating as many times as may *be necessary.*

FIGURE-OF-8 OF THE THIGHS.

Roller should be from four to six yards in length and three inches wide.

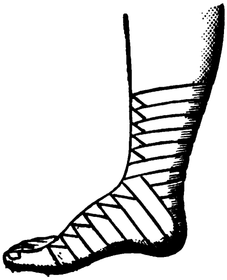
Make two circular turns above the knees, then carry the bandage obliquely over the lower part of the thigh, carry it around until it reaches the outer side of the opposite limb, and bring it down to point of departure, making as many figure-of-8 turns as may be necessary, and terminating with circular turns around the upper part of the thigh.

SPICA BANDAGE OF THE INSTEP.

The roller should be from six to eight yards long and two and a half inches wide.

Begin at the tarsal end of the metatarsal bone. Pass over the front of the foot to the first joint of the big toe of the right, or that of the little toe, if the left foot; pass under the sole to the outer or inner side, depending whether it is the right or left foot. Then make two obliques over the front of the foot, when the instep will be reached; from thence pass to the point of the heel in a line parallel with the sole; then pass around the heel, to again come to the instep, keeping parallel to the sole; cross the instep and make another similar turn, which must cover the heel and instep. Then cover over one-third of the preceding turn, and form a spica on the instep. These turns must be continued till the foot is completely covered; the bandage to be continued by circulars or spirals on the leg.

FIG. 151.



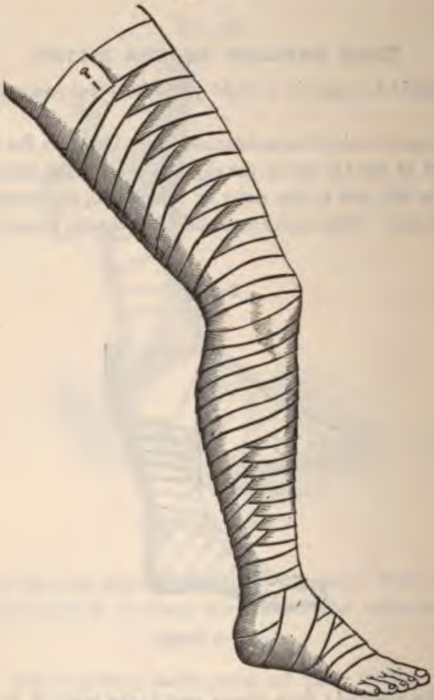
Spica, of Instep.

SPIRAL-REVERSE BANDAGE OF LOWER EXTREMITY.

The roller should be twelve yards long and two and a half inches wide.

Begin with a circular bandage at the metatarso-phalangeal articulation, take two turns, and ascend by reverse turns well up on the instep; from thence go over the point of the heel back to the instep, under the heel, around the side of the heel, and back of the heel up to the instep, under the sole of the heel over the opposite side of the heel, thence around the back of the heel to the instep; then make figure-of-8 turns of the ankle, spiral turns over the joint; spiral reverse turns to the knee; figure-of-8 turns to the knee; spiral turns over the *knee joint,* and ascend the thigh to the hip by spiral-reverse turns, and finish *by circular turns* around the upper part of the thigh.

FIG. 152.



Spiral-reverse, of Lower Extremity.

HANDKERCHIEF SYSTEM.

Mayor's handkerchief system for temporary or provisional dressing has been in vogue for the last fifty years, and is in general use.

The ordinary handkerchief or square piece of silk, cotton, or linen, folded into various shapes to suit the object indicated, is used to replace the ordinary bandage or roller.

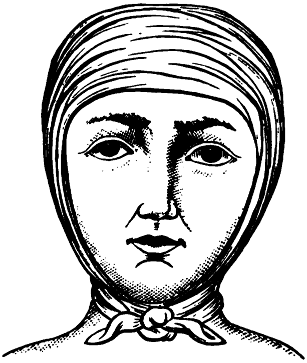
The handkerchief may be made *oblong*, *cravat-shaped*, *triangular*, or *cordiform*, to meet the necessities of the case.

It is obviously impossible to give the whole of the system of Mayor in a book of this kind; a few of the principal bandages are reproduced, that the student may understand something of the method recommended by its originator.

THE SQUARE CAP OF THE HEAD.

Having folded the handkerchief into an oblong square, and allowed the edge of the handkerchief that is to rest next to the head to be two inches shorter than the other, the ends of the long side are to be drawn to the side of the face and tied under the chin, the inner ends or those of the short side must be drawn so as to free them from the first; folding this part backward, the ends must be tied on the *occiput*.

FIG. 153.



Square Cap, of Head.

BIS-AXILLARY CRAVAT.

Place the centre in the axilla of the affected side, cross the tails over the corresponding shoulder, and then carry them one before and the other around *and behind* the chest to the axilla of the opposite side, where they are to be *secured.*

FIG. 154.

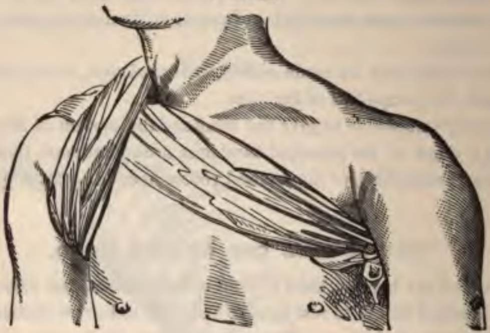
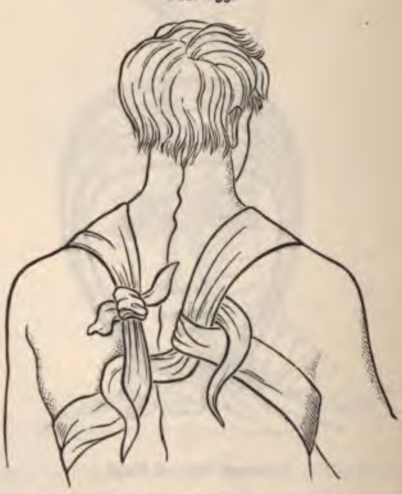


FIG. 155.



Bis-Axillary Cravat—Front and Back.

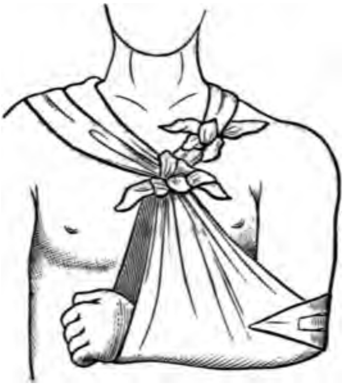
COMPOUND BIS-AXILLO-SCAPULARY CRAVAT.

Knot together the two ends of a cravat on one of the shoulders, so as to make a loose ring, then take a second cravat; apply the centre of this against the anterior face of the other shoulder, carry the tails of one over the shoulder and of the other beneath the axilla. The first must embrace the corresponding portion of the ring, so that its extremity may be united with that of the second tail, which should be made to pass about the first.

THE CERVICO-BRACHIAL SLING.

This bandage is made by placing one handkerchief around the neck and knotting its ends over the sternum. The other is to be placed in triangular form under the forearm, so that its base may be next to the wrist. Its angles are then to be tied to the handkerchief around the neck. The summit is to be carried around the elbow to fasten to the body of the triangle in front.

FIG. 156.



Cervico-Brachial Sling.

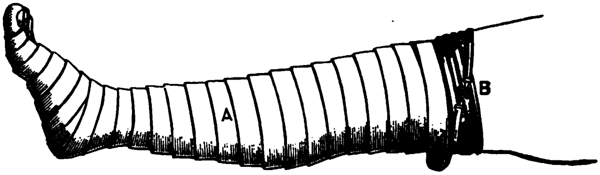
SPECIAL BANDAGES.

ESMARCH'S BANDAGE

consists of three yards of red elastic or india-rubber bandage and four feet of rubber tubing, with hook and chain. The elastic bandage is two and a half inches wide.

The bandage is used to empty the limb of its blood by rolling the india-rubber bandage from below upward to the spot where the blood is to be controlled. At this point the india-rubber tube is passed around the limb, sufficiently tight to stop the circulation in the vessels; the ends of the tube are then worked into each other.

FIG. 157.



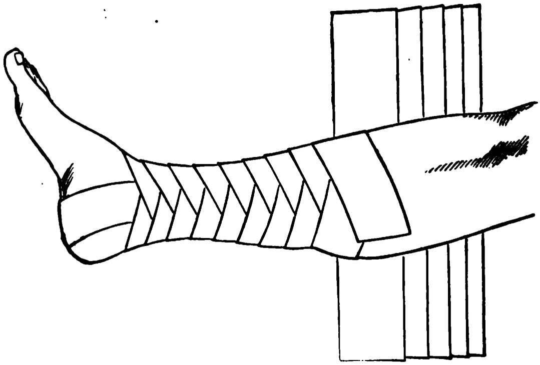
Esmarch's Bandage.

The india-rubber bandage is then removed, and the limb will remain bloodless until the tube is taken off.

BANDAGE OF SCULTETUS

consists of a number of strips about three inches wide, and of a length gradually increasing from the first strip, which should be long enough to go one and a third times around the upper part of the limb. They are arranged in such a *manner that, when* applied, each succeeding one shall overlap from one-third

FIG. 158.



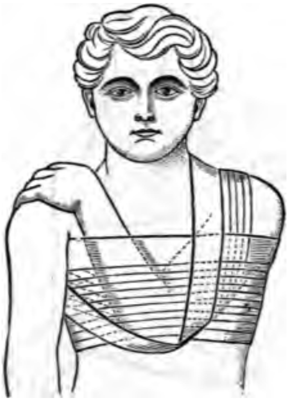
Scultetus Bandage.

to one-half of the preceding one, the compression being made in a gentle, uniform manner. It is generally used in the treatment of compound fractures and dislocations.

THE BANDAGE OF VELPEAU.

The roller should be ten yards long and two and a half inches wide. The patient having placed the hand of the injured side on the sound shoulder, and a compress having been inserted between the side of the chest and injured side so as to prevent excoriation, the initial extremity of the roller is laid under or behind the axilla of the sound side; from thence it is carried over the back, over the injured clavicle, down on the front and *outside* of the arm, under the *outside* of the elbow, and over the chest to the sound axilla. Make two similar turns, and on again reaching the axilla, pass circulars around the chest to the same axilla; then make a turn over the clavicle and arm; then a circular, continuing until it reaches the upper part of the forearm.

FIG. 159.



Velpeau's Bandage.

When a permanent dressing is needed, starch or dextrine should be applied to this bandage, and thus a firm cap will support the arm.

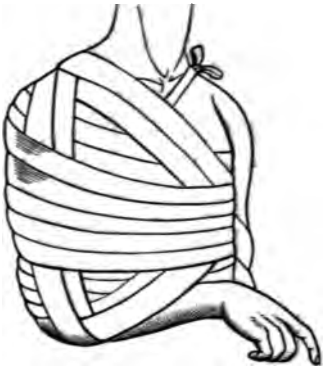
DESAULT'S APPARATUS.

There is required for this apparatus three single-headed rollers, each eight yards *long and* two and a half inches wide, a triangular wedge-shaped pad to place in the axilla, and measure four inches in width at its base and of sufficient length to reach to the elbow; a compress to cover the seat of fracture, and a sling to support the hand.

The pad is placed in the axilla, the thick end upward, where it is firmly held by an assistant. The initial end of the first roller is then placed on the middle of the pad, and at least three circular turns of the chest made, when the roller must be carried up over the front of the chest, over the sound shoulder, under the armpit, so as to make a semicircular turn on the front of the chest, then over the pad, around the back, over the shoulder, under the armpit, and then around the chest.

The forearm must now be flexed upon the arm, pressing the latter against the pad, and at the same time the shoulder should be forced upward and backward.

FIG. 160.



Desault's Apparatus.

The initial end of the second roller should be placed in the axilla of the sound side, carried across the breast, over the upper part of the arm of the injured side, and obliquely around the back to the axilla, from place of beginning, and these turns should be continued around the arm, descending to the upper part of the forearm.

The initial end of the third roller is then placed in the sound axilla, passed over the front of the chest obliquely to the seat of fracture, where there must *be placed* a compress, over this and down the back of the arm to the elbow; *thence obliquely* upward to the front of the sound axilla; under this obliquely upward over the back, over the fracture, down the front of the arm to the elbow, and thence obliquely to the back; then to the sound axilla, under this to its front part and over the chest and fractured bone, to run the same course, and end by circulars of the chest so as to fix the whole.

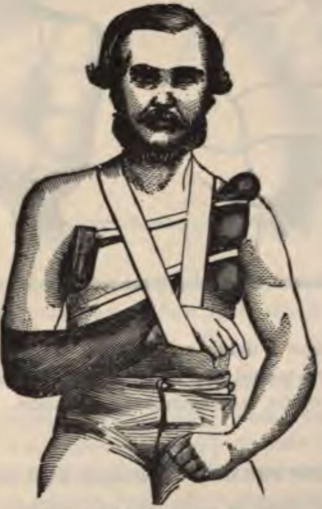
Summary of the Third Roller.—Axilla to shoulder; shoulder to elbow; elbow to axilla.

The forearm must be supported by a sling.

FOX'S APPARATUS FOR FRACTURED CLAVICLE.

Fox's apparatus is a ring, a sling, and a pad. The ring is placed on the sound shoulder; the sling is made to fit the elbow of the arm belonging to the fractured clavicle; it must extend to the wrist; it is tied to the ring by two slips of girthing forward and two back, and, in addition, one tape is attached to the lower and back part of the sling, to draw the arm back.

FIG. 161.



Fox's Apparatus.

SAYRE'S DRESSING FOR FRACTURED CLAVICLE

consists of adhesive strips. They are applied by forming a loop over the *upper* part of the injured arm; it must fit loosely. Put the arm in position, draw the strip around the body over the back, let an assistant hold it while the fragment is manipulated, then draw it tightly and secure it to the chest, thus carrying the shoulder back. Place a second strip under the elbow, and both ends over the opposite shoulder, the centre to be against the olecranon.

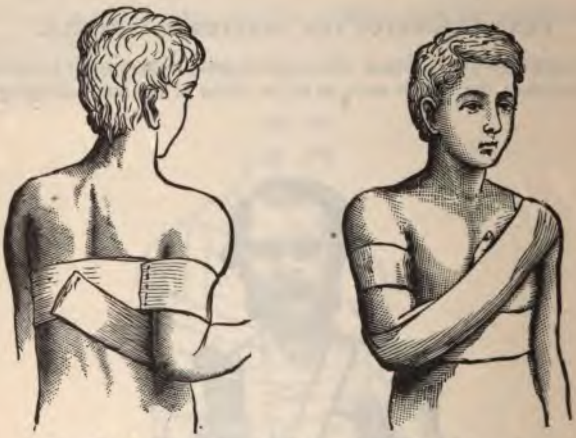


Fig. 162. Fig. 163.

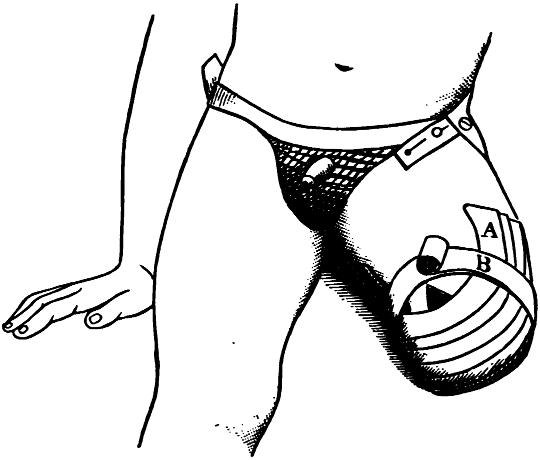
Sayre's Method of Treating Fractured Clavicle. (*Agnew.*)

THE RECURRENT BANDAGE FOR STUMP.

The roller should be about six yards long and two inches wide.

First make three circular turns around the stump, about three or four inches above the extremity; then place the thumb over the middle of the turns in front, and the forefinger behind; bring the bandage directly over the face of the stump, from the middle line in front to the same point behind. Keep the reverse in place behind by the forefinger, and bring the bandage back again, a *little to the one* side of the middle, converging when it reaches the starting point. Fix this by the thumb, bring the bandage over again, passing now to the other side of the middle line and converging to it behind. Continue these

FIG. 164.



Recurrent Bandage for Stump.

reverses till the whole stump is covered, then by one or two firm circular turns fix them in position, in which they are held by the thumb and finger.

SAYRE'S PLASTER JACKET.

Articles needed.—Freshly-burned plaster-of-Paris; knitted, elastic, woolen "skin-fitting vest;" two-, three- and four-inch wide rollers of crinoline, or cross-barred muslin, three yards long; cotton, wool and felt; two silk pocket-handkerchiefs; Sayre's triangle, with pulleys, head collar and arm loops; two basins of cold water, deep enough to submerge the rollers when set up on end, strips of thin tin plate, half-inch wide, and punched with holes to roughen their surfaces; safety pins, needle and thread; towels; black lead pencil.

In addition to the foregoing, Welsh flannel rollers and thick, soft felt are frequently required to protect the skin overlying bony projections from being chafed under the plaster case, and an apron to protect the operator's clothes.

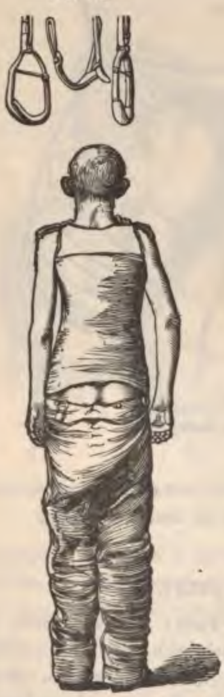
1. Prepare from six to twelve rollers, according to the size of the patient, by

gradually unrolling them on a table, while some one rubs in the powder and another person rolls the loaded bandage up loosely.

2. Erect the suspending triangle, and set ready the basins of water, bandages, pins, and other articles.

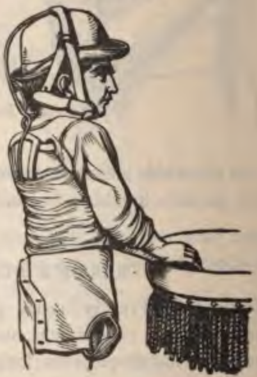
3. The body should now be thoroughly washed and dried and the "skin-fitting" shirt put on. Then beneath the shirt and next to the skin a pad of cotton wool, folded in a silk handkerchief, is slipped up in front, leaving the ends of the handkerchief hanging below the shirt. The object of this pad is to preserve a slight concavity over the pit of the stomach and navel after the *plaster has set; it is* termed the "dinner pad." In females two small pads

FIG. 165



Sayre's Plaster Jacket Applied.

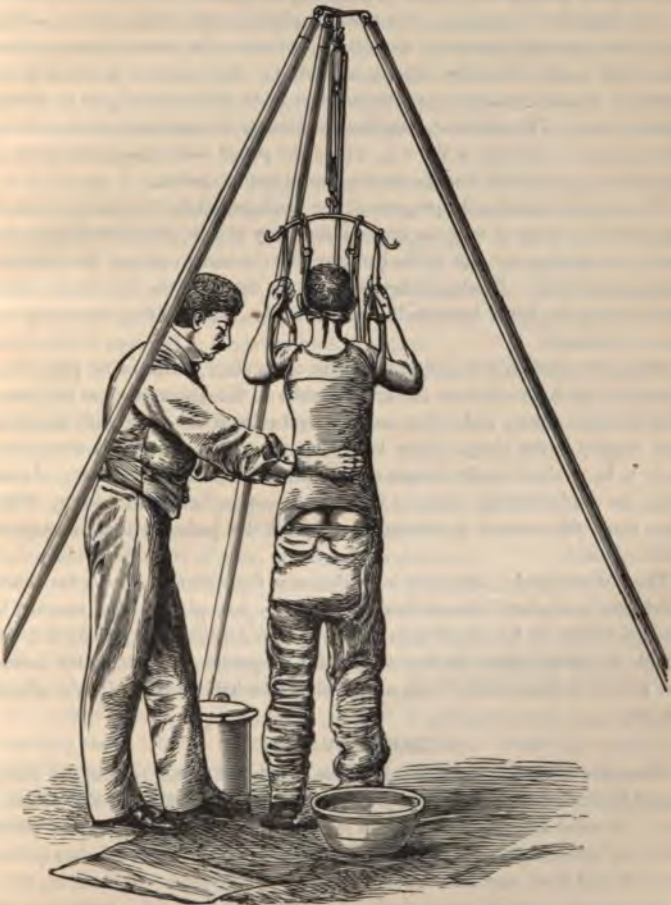
FIG. 166.



Apparatus for Disease of Cervical or Upper Dorsal Spine.

should overlie the breasts. When the pad is put on, fasten the shirt down in front and behind with safety pins, to a folded towel pressed between the thighs. A towel should be wrapped around the patient's legs to protect the dress from

FIG. 167.



Application of Sayre's Plaster Jacket.

the water or plaster. The level of the armpits, while the arms hang down, is then marked in pencil across the back and front of the shirt.

4. Arrange the patient in the suspending triangle, and let him draw himself up until his weight is supported; the tips of the toes should rest on the ground to keep steady the body. The patient must support himself by pulling the cord just so much as feels comfortable to him, and no more.

Now begin the bandaging. An assistant plunges into water a roller, so that, as it stands on end in the basin, the roller is covered with water; as soon as bubbles cease to rise from the roller it is ready for the assistant to hand to the operator; as he does so he squeezes out the excess of water and puts in another roller to soak. The operator, standing in front of the patient, rapidly rolls on the bandage, beginning at the top, where the pencil mark shows the level of the armpits; above this line the bandage must not be carried.

The assistant watches the progress of the bandage behind the patient, smoothing down the turns as they are applied, that they may fit closely to the patient's body, and wetting any part of the bandage that the water may not have reached during immersion. Bandage after bandage is then laid on the trunk, taking care to carry the lower turns well below the hips, just avoiding the pubes and great trochanters.

When the trunk is wrapped in one layer of bandage, strips of tin plate, long enough to reach nearly from the upper border to the lower one, are laid along each vertebral groove and below each armpit; these are sufficiently supple to bend readily to the shape of the body, but give the case rigidity where it is likely to be strained by the weight of the patient's head and shoulders. As the straps are applied by the assistant the surgeon covers them with a roller. When about three thicknesses of bandage are applied the jacket is thick enough in ordinary cases.

The "dinner pad" must now be withdrawn, the patient laid on a flat couch, which has been placed close to him, so that the soft plaster case may not be strained before it has hardened. The operator, while the patient lies flat, moulds the jacket about the hips and groins by gentle pressure of the hands. The patient is then covered with a light shawl for half an hour till the plaster has set.

THE JURY MAST.

When the disease in the spine is above the lower dorsal region, the jacket cannot be carried high enough to prevent the forward pressure at the diseased part. To meet this condition an iron support is attached to the plaster jacket while the bandage is being applied. From this support a steel rod rises behind the neck and head, and ends immediately above the vertex. A cross bar turning horizontally projects across the head. From this the head is slung in a jaw bandage, and thus the weight of the head is lifted off the diseased spinal column.

PERMANENT DRESSINGS.

The most reliable bandages for permanent dressings are: the plaster-of-Paris, silicate of sodium or silicate of potassium, paraffin, and the starch bandage, which is now seldom used.

The plaster-of-Paris bandage is prepared by rubbing dry plaster, of the finest quality, and freshly calcined, thoroughly into the meshes of a thick, coarse muslin or crinoline roller, which if not required for immediate use, is loosely rolled and kept in a dry place until it is needed, when it is soaked for a few minutes in cold water. The limb, first carefully enveloped in flannel, wadding, or old linen, is then surrounded by the bandage; three or four rollers generally answer the purpose.

The silicate of sodium, or potassium in a saturated solution, applied with a stout brush, is the "glass dressing" of surgeons. When well rubbed into the meshes of a wet roller, a firm and immovable apparatus is formed, in no way inferior to the plaster-of-Paris. The glass dressing dries very rapidly, does not irritate the skin, and is easily procured. From three to five layers of bandage are necessary to ensure the requisite amount of stiffness. Sometimes a binder's board will be required to impart sufficient support.

Paraffin is frequently used as a fracture dressing. After being thoroughly melted, it is partially cooled to render it more viscid; then it is rubbed thoroughly into the meshes of the bandage with a coarse paint-brush, when a neat light dressing is formed, impermeable to water, pus and other fluids, and every way adapted to the treatment of compound fractures.

The *glue* dressing is prepared by rubbing warm glue into the bandage. Before being used it must be diluted with a fifth part its bulk of alcohol, or a small quantity of oxide of zinc, to promote desiccation.

When applied in the usual manner the mixture at once begins to harden, but it does not become thoroughly dry for several hours. Wadding should be placed next to the skin, and then two or three layers of bandage must be applied. Should additional strength be needed, fresh strips of linen may be glued on, without changing the original dressing.

The *starch bandage* is now seldom used; it is applied like the glue bandage by rubbing starch into the interstices of ordinary rollers. Four and sometimes five thicknesses are required to insure sufficient support. It may be necessary to place strips of pasteboard, which have been soaked in starch, on the sides of the limb.

FORMULÆ.

SELECTED FROM STANDARD AUTHORITIES, AND FROM THOSE IN USE IN THE PRACTICE OF THE AUTHOR.

GONORRHŒA.

1. ℞. Sodæ bicarb.,
Sodæ bromid., } āā ʒ iv
Tr. belladon., ʒ j
Ext. pareiræ fld., f ʒ vj
Aq. menth. pip.,
Syr. acaciæ, } āā f ℥ iij.

Ft. M. Tablespoonful every three hours, to be used during the first days of gonorrhœa.

2. ℞. Potass. chlorat., ʒ ij
Aq. bullient., f ℥ v
Misce et adde liq. potass., f ʒ iij
Potass. acetat., ʒ iv.

M. Two tablespoonfuls three times daily for the first few days.

3. ℞. Copaibæ, ℥ j
Liq. potass., ʒ ij
Ext. glycyrrhiz. co., ʒ ss
Spir. ether. nit., ℥ j
Mucilag. acaciæ, ℥ vj
Ol. gaultheriæ, gtt. xvj.

M. A tablespoonful three times a day.

4. ℞. Mucilag. acaciæ, ℥ v
Vin. opii, ℥ j
Ol. juniperi,
Ol. cubebæ, } āā ʒ ij
Copaibæ, ℥ iij
Spir. gaultheriæ, ℥ j.

M. A teaspoonful four times daily.

5. ℞. Pulv. alum., ℥ iv
Pulv. cubebæ, ℥ iv.

M. Tablespoonful in a wineglassful of water, three times daily.

6. ℞. Copaibæ, ℥ ss
Spir. ether. nit., f ℥ ss
Pulv. acaciæ, ʒ ij
Sacchari, ℥ j
Aq. destil., f ℥ iv
Spir. lavend. co., ʒ ij
Tinc. opii, f ʒ j.

Ft. Mist. Tablespoonful three times daily.

CAPSULE C. C. AND S.

7. ℞. Salol, gr. x
Oleoresinæ cubebæ, gr. v
Para balsam copaibæ, gr. x
Pepsinæ, gr. j.

Ft. capsule, no. 1.

M. One three times a day after meals.

INJECTIONS IN GONORRHŒA.

8. ℞. Zinci sulph., gr. xv
Plumbi acet., gr. xxx
Tr. catechu,
Vin. opii, } āā f ʒ j
Aq. rosæ, f ℥ vj.

M. Use as injection night and morning.

9. ℞. Plumbi acet., gr. xxx
Zinci sulph., gr. xv
Hydrastin sulph., gr. xij
Ext. ergot. fld., fʒ iv
Tr. opii, fʒ iij
Aquæ, f℥ vj.
M. Shake well and use as injection.

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10. ℞. Hydrarg. chlor. corrosiv., gr. ss
Aquæ destil., ℥ vj.
M. Use as injection.

---

11. ℞. Acid borici, gr. ijss
Aquæ camph., ℥j.
M. Use as injection..

---

12. ℞. Zinci sulph., gr. xvj
Plumb. acet., ʒ ss
Hydrastin (Lloyd's), } āā ʒ iv
Bismuth. subnit., }
Tannin, glycerol, }
Mucilag. acaciæ, ℥ ij
Aq. dest. q. s. ut ft. ℥ vj.
M. Shake well and inject night and morning.

GONORRHŒA IN THE FEMALE.

13. ℞. Plumbi acet., } āā ʒ ij
Zinci sulph., }
Alum pulv., }
Tannin, }
Aqua, Oj.
M. Vaginal injection.

VAGINAL SUPPOSITORY IN THE CONVALESCENT STAGE OF GONORRHŒA.

14. ℞. Alum pulv., } āā ʒ iij
Plumb. subac. cerat., }
Ol. theobromæ, q. s.
Ft. suppository no. 12.
Use one night and morning.

CHILBLAINS.

15. ℞. Liniment. camphor., } āā ℥j.
Liniment. saponis, }
Cajeput. ol., }
M. S. Use locally on the unbroken skin.

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16. ℞. Acid carbol., gr. x
Vaseline, } āā ℥j.
Ol. terebin., }
M. S. Spread over the affected surface.

CHORDEE.

17. ℞. Pulv. opii, gr. ij
Camphoræ, gr. iv
Lupulin, gr. xv.
Ol. theobromæ q. s.
M. Ft. suppository. Pass into the bowel at night.

SWELLED TESTICLE (SUB-ACUTE).

18. ℞. Iodoform, } āā ʒ j
Ext. belladon., }
Ung. hydrarg., }
Ung. zinci ox., q. s. ut fiat, ℥ j.
M. To be used locally.

ACUTE CYSTITIS.

19. ℞. Belladon. succi, gtt. xx
Sodæ boras, ʒ ij
Acid benzoic, gr. xx
Tr. opii camph, ℥ iss
Ol. gaulther, gtt. xij
Syrup. simp., ℥ ij
Aq. destil., ℥ iv.
M. S. Tablespoonful in water four times daily.

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20. ℞. Potass. bicarb., ℥ j
Tr. hyoscyam., } āā ℥ ss
Kavæ kavæ ext. fld., }
Aquæ q. s. ut ft. f℥ viij.
M. Tablespoonful in a wineglassful of water, three times daily.

21. ℞. Lupulin, ʒj
Uvæ. ursi. fol., ℥ij
Aq bullien., Oj
M., and add, when cool,
Tr. opii camph., ℥ij
Sodii bicarb., ʒij.
M. Tablespoonful four times daily.

22. ℞. Lupulin, ʒj
Tr. belladon., fʒss
Tr. opii camph., f℥ij
Sodii bicarb., ʒj
Inf. buchu q.s. ut ft. f℥vj.
M. Tablespoonful in water three times daily.

GARGLES.

23. ℞. Acid tannic, ʒij
Spir. vin. rect., ʒj
Mistura camphoræ, f℥x.
M. Gargle.

24. ℞. Potass. chlor., ʒj
Tr. cinchon. comp., } aa ʒij
Tr. guaiaci ammon., }
Mel dest., ℥j
Aquæ q. s. ut ft. ℥iv.
M. Ft. gargle.

25. ℞. Potass. chlor., ʒiss
Tr. ferri chlor., ʒiij
Listerin., f℥iv.
M. Pour half an ounce in half a glass of water, and use as a gargle.

26. ℞. Potass. chlor., ʒij
Listerin., ℥j
Ol. gaultheriæ, gtt. vj
Syr. simp., ℥j
Aquæ destil., ℥ij.
M. Gargle.

MOUTH-WASH FOR MUCOUS PATCHES.

27. ℞. Acid. pyrolig., ʒj
Aquæ, ℥viij.
M. Wash mouth every four hours.

or

28. ℞. Tinct. myrrh, ℥ss
Potass. chlor., ʒiij
Aquæ, f℥iv.
M. Wash mouth every three or four hours.

STIMULATING LOTIONS AND OINTMENTS TO APPLY TO GRANULATING SURFACES AND ULCERS.

29. ℞. Cerat. resin. co., ʒj
Balsam Peruvian, ʒij
Iodoform, ʒj
Ung. petrolei, ℥j.
M. Use locally.

30. ℞. Ung. hydrarg. nit., ʒj
Pulv. jalapæ, ʒij
Balsam Peruvian, ʒj
Ung. zinc. ox., ℥j.
M. ft. ung. Use locally.

31. ℞. Ung. hydrarg. nit., ʒj
Cosmolin, ℥j.
M. ft. ung. Use locally.

LOTIONS.

32. ℞. Cupri sulph., gr. iv
Aquæ, ℥j.
M. Use locally.

33. ℞. Argent. nit., gr. ij
Aquæ destil., ℥j.
M. Use locally.

34. ℞. Acid nitric, gtt. ij
Aquæ, ℥j.
M. Use locally.

RED WASH.

35. ℞. Zinc. sulph., gr. x
Spir. rosmarin., } aa ʒiss
Tr. lavend. co., }
Aquæ, f℥x.
M. Use locally.

YELLOW WASH.

36. ℞. Hydrarg. chlor. cor., gr. j
Liquor calcis, f℥j.
M. Use locally.

BLACK WASH.

37. ℞. Hydrarg. chlor. mit., ʒ j
Liquor calcis, f℥ iv.
M. Bottle to be well shaken before using.

38. ℞. Tannin, gr. iij
Ex. opii aq., gr. ij
Cupri sulph., gr. ⅛.
M. Use locally.

SYPHILIS.

39. ℞. Mass hydrarg., āā ℈ j
Ferri sulph.,
Pulv. opii, gr. x
Quiniæ sulph., ℈ ij.
M. ft. pil. xl.
Two pills three times daily, when patient is debilitated.

40. ℞. Hydrarg. iodid. vir., gr. v
Antim. et pot. tart., gr. j
Pulv. opii, gr. v.
M. ft. pil. xxx.
One pill four times daily, when patient is robust.

41. ℞. Hydrarg. chlor. cor., gr. ½
Tr. ferri chlor., ʒ ij
Liq. arsenici chlor., gtt. xxxvj
Acid hydrochlor. dil., ʒ j
Syr. sarsaparillæ co., āā f℥ iij
Aquæ,
M. Tablespoonful in water three times daily, to be given when the patient is debilitated.

SYPHILITIC ERUPTIONS.

42. ℞. For tubercular eruption five per cent. solution of the oleate of mercury well rubbed in.

43. ℞. Hydrarg. chlor. cor., gr. iv
Benzoin, ℥ ss
Cologne water, ℥ j
Rose water, ℥ ivss.
M. Use *locally*.

TERTIARY SYPHILIS.

44. ℞. Hydrarg. chlor. cor., gr. j
Potass. iodid., ʒ ij
Syr. ferri iodid., ʒ iv
Syr. sarsaparillæ co., āā f℥ iij
Aquæ,
M. Tablespoonful in water three times daily.

TONICS.

45. ℞. Acid arsen., gr. j
Strychniæ sulph., gr. ⅛
Ferri sulph., ℈ j
Quiniæ sulph., ʒ j.
M. ft. pil. no. xx.
One pill three times daily.

46. ℞. Tr. ferri chlor., āā ℥ ss
Acid phos. dil.,
Syr. simp., ℥ iij.
M. A teaspoonful three times daily.

47. ℞. Ferri redact., ℈ j
Quiniæ sulph., āā
Ext. nucis vom., gr. x
Rhei pulv., ℈ j
Belladon. ext., gr. iij.
M. Div. in pil. xx.
S. One pill after each meal.

48. ℞. Ferri sulph., gr. ij
Magnes. sulph., ʒ j
Acid sulph. dil., ♏ x
Inf. quassii, ℥ j.
M. Tablespoonful in water three times daily.

COLD EVAPORATING LOTION.

49. ℞. Plumb. acet., ℥ j
Pulv. opii, ʒ j
Aquæ, Oj.
M. Use locally.

50. ℞. Liq. plumb. subacet., ℥ iv
Tr. opii, ʒ ij
Aquæ, Oj.
M. Use locally.

NITROUS POWDER.

51. ℞. Potass. nitrat., ʒj
Antim. et pot. tart., gr. ss
Hydrarg. chlor. mit., gr. vj.

M. ft. pulv. vj.

One powder to be taken every two hours.

---

52. ℞. Pulv. opii, gr. iij
Pulv. ipecac., gr. vj
Hydrarg. chlor. mit., gr. iss
Potass. nitrat., ʒ ss.

M. ft. pulv. vj.

One powder to be taken every three or four hours.

SODA POWDER OF GUY'S HOSPITAL.

53. ℞. Sodii carb. exsiccat. ʒj
Hydrarg. chlor. mit., gr. xij
Pulv. cretæ comp., ʒ ij.

M. Give from three to eight grains at night.

NEUTRAL MIXTURE.

54. ℞. Succi limonis, f℥iss
Potass. carb., q. s. ad saturand,
Sacchari., ʒ ij
Antim. et pot. tart., gr. ss
Aquæ destillat., f℥iij.

M. A tablespoonful every two hours.

---

55. ℞. Potass. citrat., ʒ iij
Ol. lemon, gtt. ij
Sacchar., ʒ ij
Aquæ destil., f℥iv.

M. A tablespoonful every two hours.

EFFERVESCING DRAUGHT.

56. ℞. Potass. carb., ʒ ij
Aquæ destil., f ʒ iv

Solve.

℞. Succi limon., }
Aquæ destil., } aa f ℥ ij.

M. Mix two tablespoonfuls of the lemonade with one of the alkaline solution, and let the mixture be drunk while effervescing. Repeat every two *hours.*

SPIRIT OF MINDERERUS.

57. ℞. Liq. ammon. acetat. f℥ vj
Syr. limonis, f℥ ij
Vin. antim., f ʒ iss
Spir. æther. nitros., f ʒ ij
Tinct. opii, gtt. xlv.

F. Mist. A tablespoonful every two hours.

JEFFERSON MEDICAL COLLEGE HOSPITAL FEVER MIXTURE.

58. ℞. Liq. potass. cit., ℥ss
Spir. ether. nit., ʒj
Tr. aconit. rad., gtt. ij
Morph. sulph., gr. $\frac{1}{8}$.

M. Give every third hour, in water.

SALINE MIXTURE, WITH ANTIMONY.

59. ℞. Antim. et pot. tart., gr. $\frac{1}{16}$
Tinct. aconit. rad., gtt. ij
Spir. ether. nit., ʒj
Magnes. sulph., ℈ij
Syr. zingib., }
Aquæ, } aa ʒ ij.

M. Give every third or fourth hour in fever.

FOR DELIRIUM TREMENS.

60. ℞. Potass. brom., }
Sodii brom., } aa ʒ iij
Chloral hydrat., ʒ ij
Tinct. zingib., ʒ ij
Tinct. capsici., ʒ j
Spt. ammon. aromat. ℥ iss
Aquæ, ℥ iv.

M. Dose, a dessertspoonful in water.

LOCAL ANÆSTHETIC.

61. ℞. Chloroform., ʒ iiss
Ether sulph., ʒ iv
Menthol, gr. xv.

M. Apply through an atomizer.

FOR NIGHT SWEATS.

62. ℞. Acid. camphoric, ʒ iv
Alcohol, ℥ ij
Mucilag. acacia, ℥ iij
Sp. aurant corticis, ℥ vj.

M. A dessertspoonful an hour before the sweat is expected.

ITCHING HEMORRHOIDS.

63. ℞. Pulv. gallæ, gr. v
Pulv. opii, gr. x
Cocainæ hydrochlor. ʒ ss
Ung. hydrarg., ʒ ij
Cerat. simp., ʒ vj.

M. ft. ung.

Rub well in parts on going to bed.

ENEMATA.

64. ℞. Ol. ricin., f℥ ij
Syr. fusci, f℥ ij
Sodii chlor., ʒ j
Infus. lini., tepid, Oj.

Ft. enema.

One-half to be administered at once, and the remainder in half an hour, if no evacuation is produced.

65. ℞. Saponis incisi., ℥ j
Infus. lini., tepid, Oss.

M. Use as an enema in cases of flatulence and impacted fæces.

66. ℞. Ol. terebinth., f℥ ss
Vitellum unius ovi.,
Tere simul. et adde
gradatim.
Decoct. hordei tep., f℥ x.

A stimulating injection.

SUPPOSITORY FOR BLEEDING HEMORRHOIDS.

67. ℞. Ferri subsulph., gr. iij
Plumb. acet., gr. j
Mass. hydrarg., gr. ss
Ol. theobrom q. s. ut
ft. suppos. No. 1.

Introduce one morning and evening.

GOITRE.

68. ℞. Ung. hydrarg. ox. rub., ℥ ss.

Rub well on the tumor twice a day.

69. ℞. Ichthyol, ʒ ij
Adipis, ʒ vj.

M. Use locally.

FOR STRANGURY, TENESMUS, ETC.

70. ℞. Ext. belladon., gr. ss
Pulv. opii, gr. ij
Ol. theobrom. q. s. ut
ft. suppos. No. 1.

S. Use morning and evening.

ALOPECIA.

71. ℞. Spir. ammon. aromat., f℥ j
Glycerinæ, f℥ ss
Tr. cantharid., fʒ j
Aquæ rosmarin., f℥ vij.

M. Apply to scalp morning and evening.

72. ℞. Tinct. cantharid., fʒ iss
Tr. capsici., gtt. xx
Glycerin., ℥ ss
Cologne water, ℥ j.

M. Use on the scalp at night.

73. ℞. Ext. jaborandi fld.,
Tr. canthar., } aa ℥ ss
Glycerin.,
Vaselin, ℥ iss.

M. Apply locally with a sponge morning and evening.

LINIMENTS.

74. ℞. Camphor., ℥ j
Ol. olivæ, f℥ iv
Ft. solution; tunc.
adde,
Ol. terebin., f℥ iss.

M. To be applied by rubbing with a piece of flannel.

75. ℞. Ol. olivæ,
Aq. ammon., } aa f℥j

Applied to neck in inflammation of the throat.

---

76. ℞. Tincture opii,
Spirit. camphor.
Tinct. canthar., } āā ℥ss.
Ether,

M. Make an embrocation.

---

77. ℞. Chloroform,
Ether,
Spirit. camphor, } āāf℥j
Tinct. opii,
Tinct. capsici, f℥ss

An excellent embrocation.

---

78. ℞. Chloroform,
Tr. conii, } āā ʒ iij
Tr. stramonii,
Tr. aconit. rad., ʒ v
Saponis liniment, ℥ iss.

M. Use as embrocation.

APPLICATION TO ENLARGED GLANDS.

79. ℞. Ichthyol, ʒj
Ung. hydrarg.,
" belladon., } aa ʒj.
" petrolei, ʒiv

Use locally night and morning.

ANTISEPTIC SOLUTIONS, ETC.

Bichloride of mercury solution in proportion of 1 to 1000.

80. ℞. Hydrarg. chlor. cor., ʒj
Alcohol, ℥j

A teaspoonful of this mixture to a pint of water is equivalent to one part of corrosive sublimate to a thousand parts of water.

One part corrosive sublimate to one thousand parts of water.

81. ℞. Hydrarg. chlor. cor., gr. x
Glycerinæ, ℥iss.
Aquæ destil., Gallon j.

Solution in which to place sponges, *ligatures, etc., during* an operation.

TO PREPARE SPONGES.

82. Thoroughly beat out the dust; then immerse the material for forty-eight hours in a fifteen per cent. solution of hydrochloric acid; wash it until the acid is entirely removed; steep it for half an hour in a solution of permanganate of potassium, 180 grains to 5 pints of water. Then wash it in running water, and soak it for four hours in a solution of ten ounces of hyposulphite of sodium (5 ounces of hydrochloric acid, 68 ounces water). Put it in a trough of running water, to remain six hours. Lastly, place it in a jar of solution of bichloride of mercury (1–1000), and keep it hermetically sealed until needed. After having been used, wash it in hot water, and then soak it for half an hour in a solution of sodium carbonate, half an ounce, to water one pint; rewash it in warm water, and put away in a 1–1000 bichloride solution.

TO MAKE SUBLIMATE GAUZE.

83. Dissolve one part of corrosive sublimate and two parts of common salt in five hundred parts of water; soak the gauze in this for an hour, wring it out, and partially dry it in a clean room, *i. e.*, not in a hospital ward or sick-room. Keep it in a moist condition in glass jars. The gauze generally in use is cheese-cloth, rendered absorbent by boiling in water, to which a slight amount of soda is added to remove its greasiness.

Gauze and drainage tubes should be kept in a solution of

84. ℞. Hydrarg. chlor. cor., gr. xxx
Sodii chlor., ℈vij
Glycerin., ʒiv.
Water, ½ gallon.

LISTER'S ANTISEPTIC DRESSING.

85. ℞. Potass. cyanide,	gr. 130
Mercury cyanide,	gr. 251.7
Zinc sulphate,	gr. 286.9
Hæmatoxylin,	gr. 1.3
Sal ammonia (Gas (NH_3) 1%),	♏ 6
Gauze (previously boiled and dried),	℥ 10
Sol. bichloride of mercury 1–4000,	O 7.6
Distilled water,	q. s.

Dissolve the two cyanides in two ounces of distilled water, and add the zinc sulphate dissolved in six ounces of distilled water, collect the precipitate (which will be thrown down) upon a filter and wash thoroughly by pouring over it (while still in the filter) distilled water. While the precipitate is still moist, diffuse it in eight ounces of distilled water.

Dissolve the hæmatoxylin in one and a third drachms of distilled water to which the ammonia has been added. Add this to the precipitate diffused in the water, allow to stand for three hours, then add the whole to the solution of bichloride of mercury. Draw the gauze through this. The dye salt will settle upon the gauze and fix the cyanide. The gauze should be hung upon an antiseptic cord to drain. When it is nearly dry remove and place in a tight glass jar. The superfluous moisture can be removed by pressing the gauze between the layers of a sheet if needed for immediate use.

TO CLEANSE THE SKIN PRIOR TO AN OPERATION.

86. ℞. Corrosive sublimate,	gr. vijss
Johnson's ethereal soap,	Oj.

Use *locally with* a nail brush.

TO CLEANSE THE VAGINA FOR A PLASTIC OPERATION.

87. ℞. Creolin,	ʒj
Johnson's ethereal soap,	Oj.

M. S. Use locally with a sponge.

PROFESSOR SENN'S DECALCIFIED BONE-CHIPS.

88. The tibia or femur of a freshly-killed ox is to be preferred, discarding the articular extremities; the shaft of the bone is to be sawed into segments two inches in length, which are to be placed in a fifteen per cent. solution of hydrochloric acid in distilled water, after removing the periosteum and marrow; this solution must be changed every twenty-four hours, until the segments are decalcified, which will be achieved in from two to four weeks.

The segments are then to be washed in distilled water, and afterward immersed in a dilute solution of caustic potash, to remove the excess of acid. When the acid is neutralized the segments are again immersed in distilled water for twenty-four hours, when they are taken out and the cancellous structure in the medullary canal removed. The segments are now cut into strips, in the direction of the long axis of the bone, of one-half to three-quarters of an inch in width. After this they are sliced into chips of one millimetre in thickness, which must be put in a glass-stoppered bottle containing a solution of bichloride of mercury in alcohol 1-500, and kept until required for use. During an operation the chips are to be placed in a five per cent. solution of carbolic acid.

TO PREPARE CATGUT FOR LIGATURES.

89. First immerse the catgut in ether for forty-eight hours; then place

it in a solution composed of twenty-five drops of sulphuric acid to one ounce of glycerine, for 45 minutes; from this solution it is removed and dried between bichloride towels and put in a mixture of equal parts of alcohol and Johnson's ethereal soap and allowed to stand 10 minutes; this neutralizes the acid; next put it for one hour in a solution composed of tartaric acid, one hundred grains; corrosive sublimate, twenty grains; and alcohol, five and a half ounces. Remove it and keep in alcohol until needed. During an operation it should be immersed in a solution of alcohol, one part, and bichloride of mercury solution (1–1000), four parts.

TO PREPARE CHROMIC ACID CATGUT.

90. ℞. Chromic acid, one grain
Carbolic acid, two hundred grains.
Alcohol, two drachms
Water, two ounces and six drachms.
Mix.

Place two hundred grains of catgut in ether for forty-eight hours; then immerse in the foregoing solution for two days; at the end of that time put it in tightly covered aseptic jars. When it is about to be used, put in a solution of alcohol, one part; bichloride solution (1–1000), four parts.

TO PREPARE SILKWORM GUT.

91. Immerse the gut in ether for forty-eight hours, then put it in a 1–1000 bichloride of mercury solution for an hour; remove it from this and *keep it, until* required for use, in *tubes filled with* absolute alcohol.

DEODORIZED IODOFORM.

92. ℞. Iodoform,	℥j
Menthol,	gr. xxiv
Ol. lavend.,	gtt. xxxij.

M.

---

93. ℞. *Caff. iodoform,	gr. xcvj
Ung. petrolii,	℥j.

M. Use locally.

*Caff. Iodoform is composed of equal parts of iodoform and coffee; the latter ingredient is used to disguise the smell of the iodoform.

ETHEREAL SOLUTION OF IODOFORM.

94. ℞. Iodoform,	gr. xv
Ether,	℥j.

M. To be used on chronic ulcers, abscesses, etc.

EMULSION OF IODOFORM.

95. ℞. Iodoform,	ʒx
Glycerin.,	ʒc.

M. Not over five drachms of this mixture to be used locally at one time; and in chronic abscess for each ounce of pus, four and a half grains of iodoform and forty-eight drops of glycerine are allowed to be used at any one time.

IODOFORM COLLODION.

96. ℞. Iodoform,	gr. xlviij
Collodion,	℥j.

Use locally.

BICHLORIDE OINTMENT.

97. ℞. Hydrarg. chlor. cor.,	gr. j
Ung. petrolii,	℥j.

M. Use locally.

KOUMISS.

98. ℞. White sugar, 2 tablespoonfuls
Compressed yeast, half cake
Fresh milk, one quart.

Mix, and place in an apartment ranging in temperature from 70° F. to 95° F. for six hours, turning the bottle once during the first hour. Let it remain in a refrigerator for twelve hours.

If, when the bottle is opened, the fluid is found to be sweet, the indication is that the fermentation has not been carried sufficiently far; if it is found thick and curdled, the process of fermentation has been too much prolonged. These conditions must be controlled by the length of time the fluid is kept in a warm room, or by the quantity of yeast used.

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